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JOINT CHINOOK
TECHNICAL COMMITTEE REPORT

2011 ANNUAL REPORT OF CATCHES AND ESCAPEMENTS

REPORT TCCHINOOK (12)-1

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LIST OF ACRONYMS WITH DEFINITIONS

AABM	Aggregate Abundance Based Management
AC	Allowable Catch
AI	Abundance Index
ADF&G	Alaska Department of Fish and Game
AEQ	Adult Equivalent
Agreement	June 30, 1999 PST Annex and the Related Agreement
AUC	Area-Under-the-Curve
BC	British Columbia
CBC	Central British Columbia (Kitimat to Cape Caution)
CDFO	Canadian Department of Fisheries and Oceans
CI	Confidence Interval
COLR	Columbia River
CNR	Chinook Non-Retention
CR	Chinook Retention
CRITFC	Columbia River Intertribal Fish Commission
CRFMP	Columbia River Fish Management Plan
CTAC	Columbia River Technical Advisory Committee
CTC	Chinook Technical Committee
CU	Conservation Unit
CV	Coefficient of Variation
CWT	Coded Wire Tag
ESA	U.S. Endangered Species Act
FN	First Nations
FNC	First Nations Caucus
FR	Fraser River
GW	Gitwinksihlkw
IM	Incidental Mortality
ISBM	Individual stock based management
JDF	Juan De Fuca
LGS	Lower Strait of Georgia
MA	Management Agreement
MOC	Mid Oregon Coast
MR	Mark-Recapture
MSH	Maximum sustainable harvest
MSY	Maximum Sustainable Yield for a stock, in adult equivalents
NA	Not Available
NC	North Coastal
NBC	Northern British Columbia (Dixon Entrance to Kitimat including Queen Charlotte Islands)
NMFS	National Marine Fisheries Service
NOC	Oregon Coastal North Migrating Stocks
NWIFC	Northwest Indian Fisheries Commission
ODFW	Oregon Department of Fish & Wildlife
ORC	Oregon Coast
PS	Puget Sound
PSC	Pacific Salmon Commission
PST	Pacific Salmon Treaty
QIN	Quinault Nation
QCI	Queen Charlotte Islands
SE	Standard Error
S_{MSY}	Escapement producing MSY
SEAK	Southeast Alaska Cape Suckling to Dixon Entrance
SSP	Sentinel Stocks Program
SUS	Southern U.S.
SWVI	Southwest Vancouver Island
TAC	Total Allowable Catch
TBR	Transboundary Rivers (Alsek, Taku, Stikine)
UAF	University of Alaska Fairbanks
UGS	Upper Strait of Georgia
USFWS	U.S. Fish & Wildlife Service
U.S.	United States
WAC	Washington Coast (Grays Harbor northward)
WCVI	West Coast Vancouver Island excluding Area 20
WDFW	Washington Department of Fisheries and Wildlife

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EXECUTIVE SUMMARY

The June 30, 1999 Pacific Salmon Treaty (PST) Annex and the Related Agreement (Agreement) substantially changed the objectives and structure of the Pacific Salmon Commission's (PSC) Chinook salmon fisheries and assessment of Chinook salmon stocks. The 1999 Agreement replaced the previous ceiling and pass-through fisheries with Aggregate Abundance Based Management (AABM) and Individual Stock Based Management (ISBM) fisheries. The 2008 Agreement updated and refined several aspects of the 1999 Agreement while continuing with the approach of abundance based management of PSC Chinook fisheries.

This report summarizes the 2010 fishery catches by region, provides available estimates of incidental mortality (IM) by fishery and provides limited commentary on fishery catches where needed. Landed catch is reported in the appendices for each geographic area covered under the PST. An assessment of escapement for stocks with Chinook Technical Committee (CTC) accepted goals is included, and escapement data through 2010 are provided for all escapement indicator stocks.

The escapements of 50 naturally spawning escapement indicator stocks are reviewed annually, along with the results from the Sentinel Stocks Program (SSP). Biologically-based escapement goals have been accepted by the CTC for 25 of the 50 escapement indicator stocks/stock aggregates. For 12 of these, the escapement goal is defined as a range; for the remaining 13, the escapement goal is the point estimate of S_{MSY} (escapement producing maximum sustained yield). In 2010, the percentage of stocks meeting goal or goal ranges was 80%, the highest percentage observed since 2005, indicating an improvement in stock status over the past few years. Of the five stocks below goal, one stock (Hoh Spring/Summer) was within 15% of the target goal. Four stocks were more than 15% below goal: Situk, Cowichan, Queets Spring/Summer, and Nehalem. Data for stocks without accepted goals are presented to illustrate trends in escapement. The CTC will continue to review escapement goals, as they are provided to the committee.

The CTC retrospectively evaluated the performance of the stock groups and the criteria for initiating additional management action in regards to Paragraph 13c, based upon observed escapements and exploitation rates through 2010 and stock forecasts for 2011. No stock groups listed in Attachment I-III met the criteria for triggering additional management action. However, only five of the 10 different stock groups in Attachments I-III have stocks with agreed management objectives that can be evaluated for triggering additional management action, and only six of these stocks had forecasts available for 2011. The CTC has identified a need to develop management objectives and forecast capabilities for more of the stocks included in Attachments I-III to improve the efficacy of Paragraph 13.

1 CHINOOK SALMON CATCH

The Agreement substantially changed the objectives and structure of the PSC Chinook salmon fisheries. The 1999 Agreement eliminated the previous ceiling and pass-through fisheries and replaced them with AABM and ISBM fisheries. The 2008 Agreement defines catch limits for AABM fisheries while ISBM fisheries are limited by adult equivalent (AEQ) mortality rates. Chinook salmon catches for the AABM fisheries in 2010 are summarized in Table 1.1-Table 1.4. Historical catches for PSC Chinook salmon fisheries are given in Appendices A.1-A.14.

Starting with the report CTC (2004a), the CTC included estimates of incidental mortalities associated with landed catch for each component of each AABM fishery and most ISBM fisheries (CTC 2004b). Limited commentary on both AABM and ISBM fisheries is also provided.

1.1 Review of Aggregate Abundance Based Management Fisheries

AABM fisheries for Chinook salmon are managed to achieve a target catch corresponding to a target harvest rate index and each year's abundance index (AI) in Table 1 of the Agreement. AABM fisheries are mixed stock salmon fisheries that intercept and harvest migratory Chinook salmon from many stocks. The AABM fisheries (Annex IV, Chapter 3, paragraph 2) are:

1) Southeast Alaska (SEAK) All Gear,
2) Northern BC (NBC) Troll and Queen Charlotte Islands (QCI) sport, and
3) West Coast Vancouver Island (WCVI) Troll and Outside Sport.

Catches for these three fisheries are reported in Table 1.1.

Table 1.1 Annual catches and hatchery add-ons for the Aggregate Abundance Based Management fisheries, in thousands of Chinook salmon. The treaty catches do not include the add-on or exclusions (see Section 1.1.1 and Appendix A.1). Notation is T for Troll, N for Net and S for Sport.

	Southeast Alaska (T, N, S)			**Northern British Columbia (T), Queen Charlotte Islands (S)**		**West Coast Vancouver Island (T, S)**	
	Treaty Catch		**Hatchery Add-on**	**Treaty Catch**		**Treaty Catch**	
Year	**Limit[1]**	**Observed**		**Limit[1]**	**Observed[2]**	**Limit[1]**	**Observed[2]**
1999	184.2	198.8	47.7	126.1	86.7	107.0	36.4
2000	178.5	186.5	74.3	123.5	31.9	86.2	101.4
2001	250.3	186.9	77.3	158.9	43.5	145.5	117.7
2002	371.9	357.1	68.2	237.8	150.1	196.8	165.0
2003	439.6	380.2	57.2	277.2	191.7	268.9	175.8
2004	418.3	417.0	76.0	267.0	241.5	209.6	216.6
2005	387.4	390.5[4]	65.3	240.7	243.6	179.7	202.7
2006	354.5	362.4[4]	49.1	200.0	216.0	145.5	146.9
2007	329.4	328.5[4]	69.6	143.0	144.2	121.9	139.2
2008	152.9	173.0[4]	68.2	120.9	95.6	136.9	143.8
2009[3]	176.0	230.4[4]	65.2	139.1	109.5	91.3	124.6
2010	221.8	231.6	55.8	152.1	136.6	143.7	136.8
2011	294.8			182.4		196.8	

[1] Allowable treaty catches correspond to the post season abundance indices for 1999-2010 and the preseason abundance indices for 2011.

[2] 1999-2004 Northern British Columbia and West Coast Vancouver Island observed catch changed with data from the Catch Finalization project.

[3] 2009 was the beginning of the 2008 Agreement.

[4] Values updated to reflect removal of Andrew Creek Chinook from the terminal exclusion and to include traditional troll Chinook caught in D108 in the terminal exclusion calculation during years with a directed fishery.

1.1.1 Southeast Alaska Fisheries

The SEAK Chinook salmon fishery has been managed to achieve the annual all-gear PSC allowable catch (AC) through a plan established by the Alaska Board of Fisheries. Once the all-gear AC is determined from the preseason AI each spring, this plan establishes gear quotas for the troll, net, and sport fisheries. The allocation plan reserves 4.3% of the total PSC catch for purse seine, 2.9% for drift gillnet and 1,000 fish for set gillnet fisheries. After the net quotas are subtracted, 80% of the remainder is reserved for troll gear and 20% for the sport fishery. The sport fishery is managed in season with bag-limits and other constraints. Regulatory history and maps for each SEAK fishery are described detailed in CTC (2004b).

In addition, the SEAK fisheries were managed for:

1) An Alaska hatchery add-on estimated from CWT sampling. The add-on is the total estimated Alaskan hatchery harvest, minus 5,000 base-period Alaskan hatchery harvest, and minus one-half of the 90% Confidence Interval (CI) for the total Alaskan hatchery harvest.
2) An exclusion of wild Chinook salmon originating from the Situk, Stikine and Taku Rivers, when appropriate.
3) Compliance with provisions established by the National Marine Fisheries Service in accordance with the U.S. Endangered Species Act (ESA).
4) Consistency with the provisions of the PST as required by the Salmon Fishery Management Plan of the North Pacific Fishery Management Council that was established by the U.S. Magnuson-Stevens Act.

The SEAK 2010 pre-season AI of 1.35 allowed an all-gear catch of 221,800 Chinook salmon. The preliminary all gear catch in 2010 was 287,528 with a PST catch of 231,591, an Alaska hatchery add-on of 55,816, and a terminal exclusion catch of 121. Historical SEAK Chinook salmon catch numbers for 1975-2010 are included in Appendix A.1.

1.1.1.1 Troll Fisheries Harvest

The troll fishery accounting year began with the start of the winter fishery on October 11, 2009 and ended the following September, 2010. The winter troll fishery continues until 45,000 Chinook salmon are caught or through April 30, whichever is earlier (Lynch and Skannes 2009). In 2010, the harvest in the winter fishery was less than 45,000 and the winter troll fishery was open through April 30. The spring fishery was managed so that each fishing area would not exceed a predetermined number of non-Alaskan Chinook salmon, based on the Alaska hatchery percentage in each of the areas (Lynch and Skannes 2010a). The first summer fishery opening began on July 1 and was managed to harvest 70% of the remaining troll gear Chinook salmon quota based on the pre-season AI (Lynch and Skannes 2010b). After the first 70% of the summer quota was harvested, the areas of high Chinook salmon abundance were closed and troll fishing effort was directed primarily at coho salmon. A second summer Chinook salmon retention period to harvest the remaining troll quota began on August 15, after necessary management actions for coho salmon were determined. In recent years, a small but increasing portion of the troll fleet has targeted chum salmon from mid-June through mid-August, resulting in a slight decrease in effort directed at Chinook and coho salmon.

In 2010, the troll fishery harvested 195,494 Chinook salmon, which included 21,684 Alaska hatchery fish for an Alaska hatchery add-on of 17,686, resulting in a total of 177,808 PST fish (Table 1.2). The winter fishery harvested 42,536 fish, of which 5,358 were from Alaska hatcheries and 38,205 were PST fish. The spring fishery harvested a total of 29,739, of which 11,969 were Alaska hatchery fish and 19,907 were PST fish. The total summer harvest was 123,219, of which 4,357 were from Alaska hatcheries and 119,697 were PST fish.

1.1.1.2 Net Fisheries Harvest

There are three types of commercial net fisheries conducted in SEAK, including purse seine, drift gillnet and set gillnet. The purse seine fishery is managed to harvest no more than 4.3% of the all-gear PST Chinook salmon quota and is open from mid-June through early fall. The purse seine management plan had the following provisions in 2010 (Davidson et al. 2010a):

1. Chinook salmon > 28" may not be retained
2. Chinook salmon > 21" and < 28" may be harvested but not sold

3. Chinook salmon below 21" may be retained and sold at all times.

The drift gillnet fishery is managed to catch no more than 2.9% of the PST all-gear quota and does not usually open until late June, unless fisheries are implemented to target Chinook salmon bound for the Taku and Stikine Rivers (Davidson et al. 2010b). Directed fisheries were in place in 2010 for Taku River Chinook salmon, but did not occur for the Stikine River.

The set gillnet fishery is managed to harvest no more than 1,000 PST Chinook salmon, a limit which is based on historic catch, and is open during the late spring and summer in the Yakutat area.

The 2010 total net harvest was 33,531 Chinook salmon (Table 1.2) with 25,480 Alaska hatchery fish. There was an Alaska hatchery add-on of 24,032, resulting in a PST catch of 9,499. The PST catch by gear type was 501 Chinook salmon for set gillnet, 6,073 for drift gillnet and 2,925 for purse seine.

1.1.1.3 Sport Fishery Harvest

Sport harvests are monitored in season by creel surveys throughout the region, and sampling programs are in place to recover coded-wire tagged Chinook salmon and coho salmon. The number of Alaska hatchery fish harvested is estimated from the CWTs collected by the creel program. Final sport harvest estimates are computed from a mail out survey and are available one year after the fishery occurs. In 2010, regulations for the sport fishery had a two fish daily bag limit for all residents. Non-resident anglers had a one fish daily and a three fish annual limit. The minimum size limit of 28" in total length was in effect for both resident and non-resident anglers throughout the season. In "terminal" areas near hatchery release sites, however, bag and size limit regulations were liberalized to provide for increased harvests of returning Alaska hatchery Chinook salmon. The total Chinook salmon harvest in 2010 was 58,503 with an estimate of 16,335 Alaska hatchery fish (Table 1.2). There was an Alaska hatchery add-on of 14,098 fish, resulting in a PST harvest of 44,284 Chinook salmon.

Table 1.2 Harvest of Chinook salmon in Southeast Alaska by gear type in 2010.

Gear	Total Catch	Alaskan Hatchery Catch	Alaskan Hatchery Add-on	Terminal Exclusion Catch[1]	Treaty Catch
Troll					
Winter	42,536	5,358	4,331	0	38,205
Spring	29,739	11,969	9,832	0	19,907
Summer	123,219	4,357	3,522	0	119,697
Troll subtotal	195,494	21,684	17,686	0	177,808
Sport	58,503	16,335	14,098	121	44,284
Net					
Set Net	501	0	0	0	501
Drift gillnet	17,154	12,059	11,081	0	6,073
Seine	15,876	13,421	12,951	0	2,925
Net subtotal	33,531	25,480	24,032	0	9,499
Total	287,528	63,499	55,816	121	231,591

[1] Terminal exclusion catch is a result of the harvest sharing arrangement on the Taku and Stikine Rivers.

1.1.2 British Columbia Fisheries

Under the 1999 PST Agreement, AABM regimes were implemented to constrain catch. This agreement extended through 2008 and was renewed in the 2008 PST Agreement to 2018. The NBC AABM fishery includes NBC troll catch in Statistical Areas 1-5 and QCI sport catch in Statistical Areas 1 and 2. The total NBC AABM catch in 2010 was 136,613. The WCVI AABM fishery includes the WCVI troll and a portion of the WCVI sport fishery (defined below). The total WCVI AABM catch in 2010 was 139,047 (Table 1.3). Troll catches from 1996-2004 have been updated with data from DFO (2009).

Table 1.3 Summary of landed catch by gear for Canadian Aggregate Abundance Based Management (AABM) fisheries in 2010.

AABM Fishery	Troll	Sport	Total
Northern British Columbia	90,213	46,400	136,613
West Coast Vancouver Island	84,123	54,924	139,047

1.1.2.1 Northern British Columbia Troll Fishery Harvest

The Northern British Columbia (NBC) troll fishery landed 90,213 Chinook salmon in 2010. The NBC troll fishery was opened for Chinook salmon fishing from 15 June to 8 August. The entire 2010 NBC Troll fishery was conducted under a system of individual transferable quotas. A total of 284 vessels were licensed but harvest was conducted by 147 vessels, as much of the quota was transferred. Barbless hooks and revival boxes were mandatory in the troll fishery and the minimum size limit was 67 cm. No troll test fisheries were conducted in 2010. A ribbon boundary around Langara Island and from Skonun Point to Cape Knox on Graham Island excluded the commercial troll fishery from areas within one nautical mile of the shore for the duration of the fishery.

1.1.2.2 Northern British Columbia and Central British Columbia Sport Fishery Harvest

Tidal sport fisheries in NBC and Central British Columbia (CBC), marine Statistical Areas 1-11, are managed under one set of regulations (45 cm minimum size limit; two Chinook salmon per day and four in possession; annual bag limit of 30). During the decade up to 2008, sport fisheries in the marine areas of NBC and CBC expanded substantially. Management of these marine sport fisheries now recognizes two regions: QCI, and the coastal mainland. Only the QCI sport catch is included in the AABM totals. Since 1995, catches in the QCI sport fisheries have been estimated by creel surveys, lodge logbook programs and independent observations by Canadian Department of Fisheries and Oceans (CDFO) staff. Catch for this fishery in 2010 was 46,400 Chinook salmon. The total NBC AABM catch (troll plus sport) between October 1, 2009 and September 30, 2010 was 136,613 Chinook salmon (Table 1.3).

1.1.2.3 West Coast Vancouver Island Aggregate Abundance Based Management

Under the 2008 PST Agreement, the WCVI AABM fishery includes the WCVI troll and the outside WCVI sport fishery (defined below). The total AABM landed catch in the commercial troll, outside tidal sport, and First Nations (FN) troll in 2010 was 139,047 Chinook salmon (Table 1.3).

1.1.2.3.1 West Coast Vancouver Island Troll Fishery Harvest

The AABM troll catch includes the commercial and FN troll caught Chinook salmon in Statistical Areas 21, 23-27, and 121-127. In the 2010 season (October 1, 2009-September 30, 2010), the WCVI troll fishing opportunities were consistent with a CDFO commitment to evaluate winter fisheries as a means to improve the economic base for the fleet and local communities while increasing flexibility in harvest opportunities and reducing the harvest rates on stocks encountered in summer fisheries (Table 1.4). Troll fishery openings were shaped by conservation concerns for Fraser River Spring run Age 1.2 and Fraser River Spring run Age 1.3, WCVI and Lower Strait of Georgia (LGS) Chinook salmon and interior Fraser River coho salmon.

To reduce impacts on early spring-run Fraser and LGS Chinook salmon, Southwest Vancouver Island (SWVI) areas 123-124 were closed from March 1 to late April. In addition, fisheries from late April to mid-June were managed to monthly effort quotas rather than catch quotas. To reduce impacts on interior coho, coho non-retention remained in effect for the spring/summer period, Fraser coho encounter rates were monitored, commercial fisheries were closed from mid-June through July, and plugs were used to avoid impacts on coho in August and early September fisheries. To reduce impacts on WCVI Chinook, near shore area closures were in effect from August through mid-September. To reduce impacts on LGS Chinook salmon, harvest levels were reduced during the spring period when recent impacts were highest. This measure also provides some benefits to spring run U.S. Chinook salmon stocks when the mature run is abundant on the WCVI. Statistical Area 121 (Swiftsure Bank) remained closed in 2010. Selective fishing practices were mandatory, including single barbless hooks and "revival tanks" for resuscitating coho salmon prior to release. The minimum size limits for commercial troll for all periods was 55 cm (fork length).

The 2010 commercial Area G troll anticipated harvest level was 83,700 Chinook salmon between October 1, 2009 and September 30, 2010.The actual catch for 2010 commercial troll fisheries was 79,123 Chinook salmon (Table 1.4). The April catch was 10% of the anticipated total catch at 8,553 Chinook salmon. May Chinook salmon catch in 2010 was 31,296 (37% of the total allowable catch (TAC)). The WCVI FN caught an estimated 5,000 Chinook salmon in 2010. Therefore, the total WCVI AABM troll catch for 2010 was 84,123 with 375 legal and 4,892 sublegal Chinook salmon releases (not including releases from the WCVI FN troll fisheries, which are currently unknown).

The catches for 2010 commercial troll fisheries between October 1, 2009 and September 30, 2010 were 79,123 Chinook salmon (Table 1.4). The April catch was 18,553 fish (10% of the TAC) and the May catch was 31,296 (37% of the TAC).

Table 1.4 Fishing periods and Chinook salmon harvested and released during the 2010 catch year in the West Coast Vancouver Island commercial troll fishery.

Fishing Period[1]	Areas Open	Area Predominately Fished	Landed Catch	Legal Releases	Sub-legal releases
April 19-30, 2010	Areas 23, 24, 25, 26, 27, 125, 126, 127	126	8,553	14	256
May 1 - 6, 2010	Areas 23, 24, 25, 26, 27, 124, 125, 126, 127	126/127	5,577	5	191
May 7 - 22, 2010	Areas 23, 24, 25, 26, 27, 123, 124, 125, 126, 127	123/127	25,719	75	1,078
June 1-7, 2010	Areas 23, 24, 25, 26, 27, 123, 124, 125, 126, 127	123/124	23,652	0	2,314
Aug 1-3, 2010	Areas 123, 124, 125, 126, 127	123	11,642	19	518
Sep 4 - 10, 2010[1]	Area 123	123	0	246	169
Sep 23-30, 2010	Areas 123, 124, 125, 126, 127	123/126	3,980	16	366
		Total	79,123	375	4,892

[1] West Coast Vancouver Island troll fisheries were generally closed from mid-June to late August to avoid encounters of interior Fraser River and Thompson River coho and West Coast Vancouver Island Chinook salmon.

[2] DNA sampling of sublegal Chinook salmon by Area G.

1.1.2.3.2 West Coast Vancouver Island Sport Fishery Harvest

The AABM sport fishery includes all catch in northwest WCVI (Areas 25–27, 125-127; Figure 1) between October 16 through June 30, and the catch outside of one nautical mile offshore from July 1 through October 15, plus all the catch in southwest WCVI (Areas 21–24) from October 16 through July 31, and outside one nautical mile offshore from August 1 to October 15. Catch inside the surf line and outside the AABM periods specified above is included in ISBM fishery catch.

The outer WCVI sport fishery occurs primarily in the Barkley Sound, outer Clayoquot Sound, and Nootka Sound areas. The majority of fishing effort occurs from mid-July through August in NWVI and August through mid-September in the SWVI. Creel surveys were conducted from early June to mid September. For the outside sport fishery, the Chinook salmon daily bag limit was two Chinook salmon greater than 45 cm. Barbless hooks were mandatory.

The 2010 WCVI AABM sport catch estimate during the creel period was 54,924 Chinook salmon (Table 1.5). Catch rates were determined from anglers interviewed June 1 to September 15. No creel surveys occurred between October and May, when effort is relatively low.

Table 1.5 Outer West Coast Vancouver Island Aggregate Abundance Based Management sport fishery catches of Chinook salmon by Pacific Fishery Management Areas in 2010 representing catch from June 1 to September 15 only.

Pacific Fishery Management Areas						
21/121	**23/123**	**24/124**	**25/125**	**26/126**	**27/127**	**Total**
3,504	27,944	10,931	2,342	3,711	6,494	54,924

1.2 Estimates of Incidental Mortalities in Aggregate Abundance Based Management Fisheries

1.2.1 Southeast Alaska Fisheries

Estimates of encounters and IM in SEAK fisheries are shown in Table 1.6 to Table 1.11. Data in Tables 1.6-1.11 were updated back to 2005 to reflect changes in catch estimates (see footnote in Appendix A1). Estimates were converted from landed catch into treaty catch by multiplying the landed catch estimate of encounters by the ratio of treaty catch to landed catch for each respective fishery. The 2010 troll encounters were estimated from regressions of historical encounter estimates and troll effort. The regression predicts encounter estimates from troll effort using encounter estimates obtained from direct fishery observation programs conducted during a series of years. The retention and CNR sublegal regressions use a data series from 1998-2006, while the CNR legal regression uses a data series from 1985-1988 and 1998-2006. Sport fishery releases were computed from the number of Chinook salmon caught and released as recorded on the annual Statewide Harvest Survey (mail-in survey) forms. Legal and sublegal CNR purse seine encounters were calculated using a modified catch per landing approach that uses the relationship between the yearly catch and the magnitudes of legal and sublegal CNR encounters for years where direct observational data are available. For the gillnet fishery, drop-off mortality was estimated as a percentage of the landed catch using the regional-specific drop-off rate for SEAK (CTC 2004c). Encounter estimates are multiplied by the respective IM rate found in CTC (1997) to obtain estimates of IM.

Table 1.6 Estimated treaty encounters in Southeast Alaska troll fisheries for 2002-2010.

	Summer CNR Period		CR Period
Year	Legal Encounters	Sublegal Encounters	Sublegal Encounters
2002	27,647	50,981	75,436
2003	37,529	17,620	59,170
2004	52,445	25,620	33,245
2005	43,264	19,077	33,938
2006	37,194	27,845	37,901
2007	39,758	26,331	55,896
2008	48,893	32,380	30,628
2009	47,268	31,304	38,448
2010	56,577	37,469	31,428

Refer to List of Acronyms for definitions.

Table 1.7 Estimated treaty releases in Southeast Alaska sport fisheries for 2002-2010.

Year	Legal Releases[1]	Sublegal Releases[2]
2002	25,484	38,297
2003	21,225	42,791
2004	31,859	45,488
2005	22,107	58,660
2006	22,849	55,119
2007	18,752	55,181
2008	21,644	29,535
2009	19,389	40,442
2010	13,569	28,649

[1] Legal releases pertain to fish 28" or greater and include some freshwater releases.

[2] Sublegal releases pertains to fish less than 28".

Table 1.8 Estimated treaty encounters in Southeast Alaska net fisheries for 2002-2010.

	Seine CNR Period		Seine CR Period
Year	Legal Encounters	Sublegal Encounters	Sublegal Encounters
2002	200	530	1,212
2003	581	1,544	9,437
2004	9,176	1,018	3,996
2005	0	0	5,520
2006	0	0	6,127
2007	7,472	19,844	6,572
2008	79	210	101
2009	0	0	4,094
2010	75	198	97

Refer to List of Acronyms for definitions.

Table 1.9 Estimated treaty incidental mortalities in Southeast Alaska troll fisheries for 2002-2010.

Year	LIM Drop-off	LIM CNR	LIM Total	SIM CNR	SIM CR	SIM Total
2002	2,385	6,055	8,440	13,408	19,840	33,248
2003	2,459	8,219	10,678	4,634	15,562	20,196
2004	2,575	11,486	14,061	6,738	8,744	15,482
2005	2,434	9,475	11,909	5,017	8,926	13,943
2006	2,112	8,146	10,257	7,323	9,968	17,291
2007	1,917	8,707	10,624	6,925	14,701	21,626
2008	1,009	10,708	11,716	8,516	8,055	16,571
2009	1,271	10,352	11,622	8,233	10,112	18,345
2010	1,422	12,390	13,813	9,854	8,266	18,120

Refer to List of Acronyms for definitions.

Table 1.10 Estimated treaty incidental mortalities in Southeast Alaska sport fisheries for 2002-2010.

Year	LIM Drop-off	LIM CR[1]	LIM Total[1]	SIM Total[1]
2002	1,638	4,052	5,690	6,089
2003	1,773	3,375	5,147	6,804
2004	1,995	5,066	7,060	7,233
2005	2,281	3,515	5,796	9,327
2006	2,514	3,633	6,147	8,764
2007	2,227	2,982	5,209	8,774
2008	1,176	3,441	4,618	4,696
2009	1,731	3,083	4,814	6,430
2010	1,594	2,157	3,752	4,555

[1] Numbers updated to account for freshwater releases.
Refer to List of Acronyms for definitions.

Table 1.11 Estimated treaty incidental mortalities in Southeast Alaska net fisheries for 2002-2010.

Year	LIM Drop-off[1]	LIM CNR	LIM Total	SIM CNR	SIM CR	SIM Total
2002	147	102	249	390	1,040	1,429
2003	118	297	415	1,135	8,097	9,232
2004	221	4,680	4,901	748	3,429	4,177
2005	193	0	193	0	4,736	4,736
2006	268	0	268	0	5,257	5,257
2007	210	3,811	4,021	14,585	5,639	20,224
2008	218	40	258	154	87	241
2009	198	0	198	0	3,512	3,512
2010	131	38	170	146	83	229

[1] Includes set gillnet and drift gillnet.
Refer to List of Acronyms for definitions.

1.2.2 British Columbia Fisheries

1.2.2.1 Northern British Columbia Fisheries

Table 1.12 and Table 1.13 summarize encounters for the NBC AABM fisheries from 2002 to 2010 by size class during retention and Chinook Non-Retention (CNR) fishing periods. Releases for the NBC troll fishery are based on logbook data. Encounters for the QCI sport fishery are based on creel survey and logbook programs. Table 1.14 and Table 1.15 summarize the incidental mortalities associated with the NBC troll and sport encounters. Tables 1.14 and 1.16 presents IM estimates using size specific rates from the CTC (1997). The estimated total in 2010 was 147,669 nominal fish, including 136,613 fish in the landed catch and 11,056 fish from IM (Table 1.14 and Table 1.15).

Table 1.12 Estimated Chinook salmon releases in Northern British Columbia aggregate abundance based management troll fishery for 2002-2010.

Year	Legal Releases	Sublegal Releases[1]
2002	5,240	3,714
2003	11,649	2,936
2004	24,500	10,210
2005	9,632	19,380
2006	3,310	11,095
2007	3,355	12,926
2008	1,496	5,554
2009	2,910	12,974
2010	2,075	9,816

[1] Troll sublegal releases have been corrected by a factor of 1.67 to account for underreporting.

Table 1.13 Estimated Chinook salmon releases in Northern British Columbia aggregate abundance based management sport fishery for 2002-2010.

Year	Legal Releases[1]	Sublegal Releases
2002	42,226	0
2003	47,549	0
2004	116,741	0
2005	60,987	0
2006	32,480	0
2007	35,527	0
2008	10,649	0
2009	17,234	0
2010	32,117	0

[1] Sport releases are reported as 'mixed' sizes. However, since >90% of such releases are legal-sized, all reported releases were considered to be legal-sized for the purpose of estimating incidental mortality.

Table 1.14 Estimated Chinook salmon legal incidental mortality and sublegal Incidental mortality in Northern British Columbia aggregate abundance based management troll fishery for 2002-2010.

Northern British Columbia Troll – Aggregate Abundance Based Management							
Year	LIM Dropoff	LIM CR	LIM CNR	Total LIM	SIM CR	SIM CNR	Total SIM
2002	1,751	0	1,085	2,836	839	42	880
2003	2,378	0	2,465	4,843	643	53	696
2004	2,878	133	5,280	8,291	648	1,772	2,420
2005	2,972	801	1,342	5,114	3,296	1,297	4,593
2006	2,575	560	111	3,245	2,469	160	2,630
2007	1,415	484	214	2,114	2,536	527	3,063
2008	886	90	212	1,189	1,156	160	1,316
2009	1,283	85	538	1,905	1,768	1,307	3,075
2010	1,534	126	293	1,953	1,360	967	2,326

Refer to List of Acronyms for definitions.

Table 1.15 Estimated Chinook salmon legal incidental mortality and sublegal incidental mortality in Northern British Columbia aggregate abundance based management sport fishery for 2002-2010.

Northern British Columbia Sport – Aggregate Abundance Based Management				
Year	LIM Dropoff[1]	LIM CR	Total LIM	Total SIM
2002	1,696	6,714	8,410	0
2003	1,955	7,560	9,515	0
2004	2,664	18,562	21,226	0
2005	2,477	9,697	12,174	0
2006	2,322	5,164	7,486	0
2007	2,196	5,649	7,845	0
2008	1,566	1,693	3,259	0
2009	1,224	2,740	3,964	0
2010	1,670	5,107	6,777	0

[1] Legal drop-off mortality is computed from landed catch, incorporating both an encounter ratio and a mortality rate.
Refer to List of Acronyms for definitions.

1.2.2.2 West Coast Vancouver Island Fishery

The estimated total mortality of Chinook salmon in the WCVI AABM fisheries in 2010 was 155,064 nominal fish, including 139,047 Chinook salmon in the landed catch and 16,017 fish from IM (Table 1.16 and Table 1.17). The estimated IM included 12,185 legal and 3,832 sublegal nominal fish. The estimates for the commercial troll fisheries in 2010 are based on landed catch multiplied by encounter rates from previous years. Table 1.18 and

Table 1.19 summarize encounters for these fisheries by size class during retention and CNR fisheries. In 2010, a non-retention AABM troll fishery opened in September to collect sublegal Chinook salmon DNA samples.

Table 1.16 Estimated Chinook salmon releases in West Coast Vancouver Island aggregate abundance based management troll fishery.

Year	Legal Releases	Sublegal Releases [1]
2002	7,943	22,485
2003	70	25,850
2004	0	17,415
2005	550	17,248
2006	3,522	12,789
2007	250	14,405
2008	65	12,079
2009	345	6,976
2010	375	8,170

[1] Troll sublegal releases have been corrected by a factor of 1.67 to account for underreporting.

Table 1.17 Estimated Chinook salmon releases in West Coast Vancouver Island aggregate abundance based management sport fishery.

Year	Legal Releases	Sublegal Releases
2002	12,326	7,507
2003	23,156	6,333
2004	16,061	5,485
2005	19,323	4,571
2006	11,882	6,048
2007	5,973	15,590
2008	14,483	8,068
2009	16,520	27,863
2010	35,879	9,873

Table 1.18 Estimated Chinook salmon legal incidental mortality and sublegal incidental mortality in West Coast Vancouver Island aggregate abundance based management troll fishery for 2002-2010.

West Coast Vancouver Island Troll – Aggregate Abundance Based Management[1]							
Year	LIM Dropoff	LIM CR	LIM CNR	Total LIM	SIM CR	SIM CNR	Total SIM
2002	2,149	0	1,604	3,754	5,329	0	5,329
2003	2,495	0	14	2,509	6,126	0	6,126
2004	2,995	0	0	2,995	4,127	0	4,127
2005	2,530	111	0	2,641	4,088	0	4,088
2006	1,853	86	625	2,565	2,738	293	3,031
2007	1,603	51	0	1,653	3,414	0	3,414
2008	1,618	13	0	1,631	2,863	0	2,863
2009	989	27	43	1,059	1,551	103	1,653
2010	1,430	26	50	1,506	1,869	67	1,936

[1] West Coast Vancouver Island troll catch data has been corrected from TCCHINOOK 11-1 to remove "out of area" data.

Refer to List of Acronyms for definitions.

Table 1.19 Estimated Chinook salmon legal incidental mortality and sublegal incidental mortality in West Coast Vancouver Island aggregate abundance based management sport fishery for 2002-2010.

West Coast Vancouver Island Sport – Aggregate Abundance Based Management				
Year	LIM Dropoff	LIM CR	Total LIM	Total SIM
2002	2,174	2,367	4,540	1,441
2003	1,851	4,446	6,297	1,216
2004	2,697	3,084	5,781	1,053
2005	3,497	3,710	7,207	878
2006	2,519	2,281	4,800	1,161
2007	3,196	1,147	4,343	2,993
2008	3,488	2,781	6,269	1,549
2009	4,583	3,172	7,755	5,350
2010	3,790	6,889	10,679	1,896

Refer to List of Acronyms for definitions.

1.3 Review of Individual Stock Based Management Fisheries

1.3.1 Canadian Individual Stock Based Management Fisheries

The Canadian ISBM fisheries include all fisheries that harvest or release Chinook salmon in British Columbia that are not AABM fisheries. In 2010, 164,145 Chinook salmon were harvested in Canadian ISBM fisheries in British Columbia and Canadian sections of the Transboundary Alsek, Taku and Stikine Rivers. Total estimated IM in 2010 was 9,391 legal and 6,894 sublegal Chinook salmon. The distribution of the landed catches and estimated incidental mortalities are presented in Table 1.20. Historical catches are in Appendixes A2 through A8. Troll and net catches from 1996-2004 have been updated with data from DFO (2009). The former Georgia Strait and Fraser River Appendix has been separated into two Appendix tables and the series of Fraser data has been updated.

Table 1.20 Landed catch and incidental mortalities in Canadian Individual Stock Based Management fisheries for 2010.

Region	Fishery	Landed Catch	Release Legal	Release Sublegal	Total IM - Legal	Total IM - Sublegal	Total IM
Transboundary Rivers	Gillnet	7,815	64	60	359	57	416
	Freshwater Sport	247	0	0	17	0	17
	FN	835	0	0	38	0	38
Regional Total		**8,897**	**64**	**60**	**415**	**57**	**472**
Northern British Columbia	Gillnet	2,182	0	0	100	0	100
	Seine	0	0	0	0	0	0
	Tyee Test Fishery	959	0	0	44	0	44
	Tidal Sport	7,570	386	177	273	28	301
	Freshwater Sport	2,689	0	0	186	0	186
	FN	13,693	0	0	630	0	630
Regional Total		**27,093**	**386**	**177**	**1,232**	**28**	**1,261**
Central British Columbia	Troll	0	0	0	0	0	0
	Gillnet	1,549	0	0	71	0	71
	Seine	0	0	0	0	0	0
	Tidal Sport	4,043	0	0	146	0	146
	FN	3,710	0	0	171	0	171
Regional Total		**9,302**	**0**	**0**	**387**	**0**	**387**
West Coast Vancouver Island Terminal	Gillnet	1,747	0	107	80	101	182
	Seine	0	0	265	0	191	191
	Tidal Sport	24,687	7,936	4,785	1,703	919	2,622
	FN gillnet	7,485	0	0	344	0	344
	FN setnet	0	0	0	0	0	0
Regional Total		**33,919**	**7,936**	**5,157**	**2,128**	**1,211**	**3,339**
Johnstone Strait	Troll	2	0	428	0	101	101
	Gillnet	62	675	11	3	10	13
	Seine	36	1,952	270	26	194	220
	Tidal Sport	10,016	1,158	7,934	691	1,523	2,214
	Freshwater Sport	0	0	0	0	0	0
	FN	250	0	0	12	0	12
Regional Total		**10,366**	**3,785**	**8,643**	**731**	**1,830**	**2,561**
Georgia Strait	Troll	5	0	359	0	85	85
	Gillnet	3	64	0	0	0	0
	Seine	51	996	68	37	49	86
	Tidal Sport	14,942	1,538	12,167	1,031	2,336	3,367
	FN	40	0	0	2	0	2
Regional Total		**15,041**	**2,598**	**12,594**	**1,070**	**2,470**	**3,540**
Juan De Fuca	Gillnet	206	16	66	9	62	72
	Seine	0	687	470	0	338	338
	Tidal Sport	15,612	2,089	2,779	1,077	534	1,611
	FN	0	0	0	0	0	0
Regional Total		**15,818**	**2,792**	**3,315**	**1,087**	**934**	**2,021**
Fraser River	Gillnet	9,476	3	64	436	61	496
	Mainstem Sport	6,479	1,229	84	447	16	463
	FN-FoodSocialCeremonial	15,432	298	0	710	0	710
	FN –Economic Opportunity	4,477	0	0	206	0	206
	Tributary Sport	7,845	10,698	1,501	541	288	829
Regional Total		**43,709**	**12,228**	**1,649**	**2,340**	**365**	**2,705**
Grand Total		164,145	29,789	31,594	9,391	6,894	16,285

Refer to List of Acronyms for definitions.

1.3.2 Southern U.S. Individual Stock Based Management Fisheries

Southern U.S. fisheries of interest to the PSC, generally those north of Cape Falcon, Oregon, are managed in accordance with legal obligations stemming from treaties between Indian tribes and the United States. In 1974, *U.S. v Washington* set forth sharing obligations to meet treaty fishing rights in western Washington. Treaty rights of Columbia River tribes were defined by *U.S. v Oregon*, and the Columbia River Fisheries Management Plan was implemented in 1977. In reporting these fisheries, fishermen are termed "treaty" if they are fishing under the Native American Treaty fishing rights and "non treaty" otherwise. As specified in the 2008 agreement, all southern U.S. fisheries are ISBM fisheries. Historical catches in these fisheries may be found in Appendices A.8 through A.14.

1.3.2.1 Strait of Juan de Fuca and the San Juan Islands

The preliminary estimate of the 2010 Chinook salmon catch in Strait of Juan de Fuca tribal net fisheries was 2,245 fish with the majority of these taken during fisheries targeting Fraser River sockeye. There were 5,950 Chinook salmon harvested in the San Juan Islands net fisheries. The preliminary estimate of the 2010 Strait of Juan de Fuca treaty troll fishery is 2,011 Chinook salmon through December. The catch estimate does not include catches from Area 4B during the May-September Pacific Fisheries Management Council management period. Historic catch estimates are provided in Appendices A.9 and A.10 for the Strait of Juan de Fuca and San Juan areas respectively.

1.3.2.2 Puget Sound

The preliminary estimate of the 2010 tribal and non-tribal net fishery harvests in Puget Sound marine areas is 40,357 (32,775 tribal, 7,582 non-tribal) for all marine areas excluding Strait of Juan de Fuca (Area 4B, 5, 6, 6A, 6B, and 6C) and San Juan Islands (Area 7 and 7A). Additional tribal net harvest occurred in freshwater fisheries with a preliminary estimate of 32,219. Estimates of the sport catch in 2010 are not yet available. Historic catch tables for Puget Sound exclusive of the Strait of Juan de Fuca and San Juan Islands are provided in Appendix A.11.

1.3.2.3 Washington Coast Terminal

Tribal commercial, ceremonial and subsistence fisheries harvested 2,373 Chinook salmon in north coastal rivers (Quinault, Queets, Hoh, and Quillayute) in 2010. An additional 10 Chinook salmon were harvested by the Makah tribal fisheries in the Waatch and Sooes Rivers.

Harvest in Grays Harbor includes catch from both the Humptulips and Chehalis Rivers. The 2010 tribal net fisheries harvested an estimated 1,526 Chinook salmon. The 2010 non-Indian commercial net harvest in Grays Harbor was 1,239 Chinook salmon. Approximately 8,095 Chinook salmon were harvested by non-Indian commercial net fisheries in Willapa Bay in 2010.

From Grays Harbor north, sport fisheries were implemented based upon pre-season tribal-state agreements and were subject to in-season adjustment. Estimates of sport fishery catches for Washington coastal terminal fishing areas in 2010 are not available. Historic catch estimates for Washington Coastal inside fisheries are shown in Appendix A.12.

1.3.2.4 Columbia River

Chinook salmon from the Columbia River are divided into eight stock groups for management purposes. These groups are delineated by run timing and area of origin: (1) spring run originating below Bonneville Dam; (2) spring run originating above Bonneville Dam; (3) summer run originating above Bonneville Dam; (4) fall run returning to Spring Creek Hatchery; (5) fall run originating in hatchery complexes below Bonneville Dam; (6) wild fall run originating below Bonneville Dam; (7) upriver bright fall run; and (8) mid-Columbia bright fall hatchery fish.

In 2010, the total annual harvest for all fisheries (spring, summer and fall) in the Columbia River basin was 415,441 Chinook salmon, which included non-Indian commercial net harvest of 87,082, sport harvest of 143,472 and treaty Indian commercial, ceremonial and subsistence harvest of 184,887 Chinook salmon. Historic catch estimates for Columbia River fisheries are shown in Appendix A14.

1.3.2.5 Oregon Coast Terminal

Most harvest in ocean fisheries off Oregon's coast is comprised of a mixture of southern Chinook salmon stocks not included in the PSC agreement. These stocks do not migrate north into the PSC jurisdiction to any great extent. Some stocks originating from Oregon coastal streams do migrate into PSC fisheries, including the North Oregon Coastal (NOC) and Mid-Oregon Coastal (MOC) stock aggregates. The NOC stocks are harvested only incidentally in Oregon ocean fisheries, while the contribution of MOC stocks to Oregon ocean fisheries is believed to be much greater. Catch statistics are readily available only for a terminal area troll fishery on one MOC stock at the mouth of the Elk River. Late season (October-December) troll catch in the Elk River terminal troll fishery in 2010 was 1,315 Chinook salmon.

Sport catch of these two stock groups occurs primarily in estuary and freshwater areas as mature fish return to spawn and is reported through a "punch card" accounting system. These data are only available more than two years after the current season. Therefore, only the inriver and estuary sport catch though 2009 is reported for the NOC and MOC groups. The 2009 punch card estimate of estuary and freshwater catch for the NOC and MOC groups is 16,647 Chinook salmon. Historical catch estimates for the Elk River troll fishery and the estuary and freshwater sport fisheries targeting on MOC and NOC stocks are shown in Appendix A.15.

1.3.2.6 North of Cape Falcon

Ocean fisheries off the coasts of Washington, Oregon, and California are managed under regulations recommended by the Pacific Fishery Management Council. The estimated catch of Chinook salmon in commercial troll fisheries from Cape Falcon, Oregon to the U.S.-Canada border in 2010 was 89,601 for both treaty and non-treaty fisheries combined. Estimated catch in the ocean sport fishery north of Cape Falcon in 2010 was 38,686 Chinook salmon. Historic catch estimates for U.S. ocean fisheries north of Cape Falcon are shown in Appendix A.13.

1.4 Estimates of Incidental Mortality for Southern U.S. Fisheries

Table 1.21 shows estimates of incidental mortalities for Washington Coast (WAC) and Puget Sound (PS) fisheries. Sources of estimates are shown in the table footnotes. No estimates of incidental mortalities were provided for 2010 for ocean fisheries south of Cape Falcon or COLR fisheries.

Table 1.21 Estimated incidental mortality in Southern U.S. troll, net, and sport fisheries for 2010.

Fishery	Troll	Net[1]	Sport
Strait of Juan de Fuca	365[2]	67[1]	3,682[3]
San Juan Islands	0	1,641[4]	3,031[3]
Puget Sound	0	1,211[1]	25,321[3]
Washington Coast Terminal	0	278[1]	NA
Columbia River	NA	8,159[4]	NA
Oregon Coast Terminal	NA	NA	NA
North of Cape Falcon	13,100[5]	NA	4,600[5]

[1] Assume 3% net dropout rate applied to marine area catch.

[2] Estimate from modeled preseason incidental mortality rate applied to actual landed catch.

[3] Estimates from preseason FRAM in marine areas.

[4] Appendix A.14 non-treaty gillnet and treaty Indian catches times 3%.

[5] Estimates from direct observations.

2 CHINOOK SALMON ESCAPEMENTS

2.1 Introduction

The Agreement established a Chinook salmon management program that:

"introduces harvest regimes that are based on estimates of Chinook salmon abundance, that are responsive to changes in Chinook salmon production, that take into account all fishery induced mortalities and that are designed to meet MSY or other agreed biologically-based escapement objectives"

This chapter compares annual escapement estimates with maximum sustained yield (MSY) or other agreed biologically-based escapement goals established for Chinook salmon stocks. The CTC has reviewed and accepted escapement goals for 25 stocks included in this report.

This annual report, like those prior to 2006 (see CTC 2005a) includes a section on the framework used for escapement assessments and narratives for each stock that includes a description of escapement methodology, escapement goal basis, and agency comments. Annual reports from 2006-2010 used an abbreviated narrative for each stock.

Escapement goals accepted by the CTC were based on analyses that followed the guidelines developed in the CTC escapement goal report (CTC 1999). In the stock-specific narratives presented with the escapement graphs, only CTC-accepted escapement goals and ranges (in gray shading) are shown on the escapement graphs and used for evaluation. Table 2.1 presents the status of escapement goal reviews by the CTC for stocks identified as escapement indicator stocks.

Table 2.1 Pacific Salmon Commission Chinook salmon escapement indicator stocks, where shading indicates that there is not a Chinook Technical Committee accepted escapement goal for assessment of stock status.

Presence in Treaty Attachments					**Stock Group In Att. I-V**	**Escapement Indicator**	**Region**	**Run**
SEAK	**NBC/ QCI**	**WCVI**	**BC ISBM**	**SUS ISBM**				
✓						Situk	Yakutat	Spring
✓						Alsek	TBR	Spring
✓						Taku	TBR	Spring
✓						Stikine	TBR	Spring
✓						Chilkat	N Inside	Spring
✓						King Salmon	N Inside	Spring
✓						Andrew Creek	C Inside	Spring
✓						Unuk	S Inside	Spring
✓						Chickamin	S Inside	Spring
✓						Blossom	S Inside	Spring
✓						Keta	S Inside	Spring
✓	✓		✓		North/Central British Columbia	Yakoun	NBC-Area 1	Summer
✓	✓		✓		North/Central British Columbia	Nass	NBC-Area 3	Spring/Summer
✓	✓		✓		North/Central British Columbia	Skeena	NBC-Area 4	Spring/Summer
			✓		North/Central British Columbia	Dean	CBC-Area 8	Spring
						Rivers Inlet	CBC-Area 9	Spring/Summer
✓	✓		✓		West Coast Vancouver Island Falls	Artlish, Burman, Kaouk, Tahsis, Tashish, Marble	WCVI	Fall
✓	✓		✓		Upper Strait of Georgia	Klinaklini , Kakweiken, Wakeman, Kingcome, Nimpkish	UGS	Sum/Fall
			✓		Lower Strait of Georgia	Cowichan/Nanaimo[2]	LGS	Fall
✓	✓		✓		Fraser Early[1] (Spr/Sum)	Fraser Spring 1.3	FR	Spring
✓	✓		✓		Fraser Early[1] (Spr/Sum)	Fraser Spring 1.2	FR	Spring
✓	✓		✓		Fraser Early[1] (Spr/Sum)	Fraser Summer 1.3	FR	Summer
✓	✓		✓		Fraser Early[1] (Spr/Sum)	Fraser Summer 0.3	FR	Summer
		✓	✓	✓	Fraser Late	Harrison	FR	Fall
			✓	✓	North Puget Sound Natural Springs	Nooksack	NC/PS	Spring
			✓	✓	North Puget Sound Natural Springs	Skagit Spring	NC/PS	Spring
		✓	✓	✓	Puget Sound Natural Summer/Falls	Skagit Summer/Fall	NC/PS	Summer/Fall
		✓	✓	✓	Puget Sound Natural Summer/Falls	Stillaguamish	NC/PS	Summer/Fall
		✓	✓	✓	Puget Sound Natural Summer/Falls	Snohomish	NC/PS	Summer/Fall
		✓	✓	✓	Puget Sound Natural Summer/Falls	Lake Washington	NC/PS	Summer/Fall
		✓	✓	✓	Puget Sound Natural Summer/Falls	Green	NC/PS	Summer/Fall

-continued-

Table 2.1 Continued.

Presence in Treaty Attachments					Stock Group In Att. I-V	Escapement Indicator	Region	Run
SEAK	NBC/ QCI	WCVI	BC ISBM	SUS ISBM				
✓	✓			✓	Washington Coastal Fall Natural	Hoko	WAC/JDF	Fall
						Quillayute Summer	WAC/JDF	Summer
✓	✓			✓	Washington Coastal Fall Natural	Quillayute Fall	WAC/JDF	Fall
						Hoh Spring/Summer	WAC/JDF	Summer
✓	✓			✓	Washington Coastal Fall Natural	Hoh Fall	WAC/JDF	Fall
						Queets Spring/Summer	WAC/JDF	Summer
✓	✓			✓	Washington Coastal Fall Natural	Queets Fall	WAC/JDF	Fall
						Grays Harbor Spring	WAC/JDF	Spring
✓	✓			✓	Washington Coastal Fall Natural	Grays Harbor Fall	WAC/JDF	Fall
						COLR Upriver Spring	COLR	Spring
✓	✓	✓		✓	Columbia River Upriver Summers	Mid-COLR Summers	COLR	Summer
✓	✓	✓		✓	Columbia River Falls	COLR Upriver Bright	COLR	Fall
✓	✓	✓		✓	Columbia River Falls	Lewis	COLR	Fall
✓	✓	✓		✓	Columbia River Falls	Deschutes	COLR	Fall
✓	✓			✓	Far North Migrating Oregon Coastal	Nehalem	NOC	Fall
✓	✓			✓	Far North Migrating Oregon Coastal	Siletz	NOC	Fall
✓	✓			✓	Far North Migrating Oregon Coastal	Siuslaw	NOC	Fall
						South Umpqua	MOC	Fall
						Coquille	MOC	Fall

[1] The escapement indicator stocks listed in the Annex tables for this group are Upper Fraser, Middle Fraser, and Thompson. The Fraser spring/summer group is split into these 4 escapement indicators to represent the stock group by life history type rather than geographically.

[2] An escapement goal was established for the Cowichan in 2005; a goal for Nanaimo is still pending.

Refer to List of Acronyms for definitions.

2.2 Escapement Goal Assessments

The Agreement directs the CTC to "report annually on the escapement of naturally spawning Chinook salmon stocks in relation to the agreed escapement objectives referred to below, evaluate trends in the status of stocks, and report on progress in rebuilding of naturally spawning Chinook salmon stocks" (Annex IV, Chapter 3, Paragraph 1.b.iii). In this report, escapement assessments include stock specific graphs of escapements and commentary, presented to provide a perspective on stock status and escapement trends through 2010.

The escapement goals and 2010 escapements for the 25 stocks with CTC accepted escapement goals are listed in Table 2.2. For 12 of these stocks, the agency escapement goal is defined as a range; for the remaining 13 stocks, the escapement goal is defined as a point estimate. In 2010, escapements were within the goal range for six stocks, above the range or SMSY point estimate for 14 stocks, and below the goal for five stocks.

The CTC has now assessed the status of stocks with CTC-accepted goals for return years 1999-2010. Over this time period, the number of stocks with CTC-accepted goals has increased from 16 to 25 (Figure 2.1). From 1999-2009, the percentage of stocks that met or exceeded escapement goals or goal ranges has varied from 46% to 96%. In 2010, the percentage of stocks that met or exceeded goal was 80%, the highest percentage observed since 2005. Of the five stocks below goal, one stock (Hoh Spring/summer) was within 15% of the target goal. Four stocks were more than 15% below goal: Situk, Cowichan, Queets spring/Summer, and Nehalem.

Table 2.2 Escapement goals, 2009 and 2010 escapements, and 2011 forecasts for stocks with Chinook Technical Committee agreed goals. Percentages relative to goals are in parentheses. Escapements below the goal or lower bound of the escapement range are shaded; escapements or forecasts below the 85% threshold applicable to Attachment I-III are bold.

Stock	Region	Stock Group	Escapement Goal	2009 Escapement	2010 Escapement	2011 Forecast
Situk	SEAK	Yakutat	500-1,000	902 (180%)	**167 (33%)**	NA
Alsek	SEAK/TBR	TBR	3,500-5,300	6,095 (174%)	9,428 (269%)	NA
Chilkat	SEAK	Northern Inside	1,750-3,500	4,429 (253%)	1,852 (106%)	NA
Taku	SEAK/TBR	TBR	19,000-36,000	22,806 (120%)	29,307 (154%)	NA
Stikine	SEAK/TBR	TBR	14,000-28,000	**11,086 (79%)**	15,177 (108%)	NA
King Salmon	SEAK	Northern Inside	120-240	109 (91%)	158 (132%)	NA
Andrew Creek	SEAK	Central Inside	650-1,500	628 (97%)	1,205 (185%)	NA
Unuk (survey index)	SEAK	Southern Inside	1,800-3,800	3,157 (175%)	4,290 (238%)	NA
Chickamin (survey index)	SEAK	Southern Inside	450-900	611 (136%)	1,023 (227%)	NA
Blossom (survey index)	SEAK	Southern Inside	150-300	**123 (82%)**	180 (120%)	NA
Keta (survey index)	SEAK	Southern Inside	175-400	219 (125%)	475 (271%)	NA
Harrison	BC	Fraser River	75,100-98,500	70,141 (93%)	103,515 (138%)	NA
Cowichan	BC	LGS	6,500	**785 (12%)**	**2,879 (44%)**	NA
Mid COLR Upriver Summer	COLR	COLR	17,857	20,037[1] (112%)	23,994[1] (134%)	50,762[1] (284%)
COLR Upriver Brights	COLR	COLR	40,000	85,759 (214%)	167,007 (418%)	134,384 (335%)
Deschutes River Fall	COLR	COLR	4,532	6,429 (142%)	9,275 (205%)	NA
Lewis	COLR	COLR	5,700	5,410 (95%)	8,701 (153%)	9,420 (165%)

Stock	Region	Stock Group	Escapement Goal	2009 Escapement	2010 Escapement	2011 Forecast
Quillayute Fall	WAC	WAC	3,000	3,130 (104%)	4,635 (155%)	NA
Queets Spring/Summer	WAC	WAC	700	**495 (71%)**	**382 (55%)**	NA
Queets Fall	WAC	WAC	2,500	4,156 (166%)	4,022 (161%)	NA
Hoh Spring/Summer	WAC	WAC	900	**880 (98%)**	**828 (92%)**	NA
Hoh Fall	WAC	WAC	1,200	2,081 (173%)	2,599 (217%)	NA
Nehalem	ORC	NOC	6,989	**5,332 (76%)**	**5,384 (77)%**	7,578 (108%)
Siletz	ORC	NOC	2,944	2,905 (99%)	4,225 (144%)	4,270 (145%)
Siuslaw	ORC	NOC	12,925	14,094 (109%)	22,197 (172%)	26,130 (202%)

[1] May not be directly comparable to the escapement goal since accounting methods differ from those used to develop the goal.

Refer to List of Acronyms for definitions.

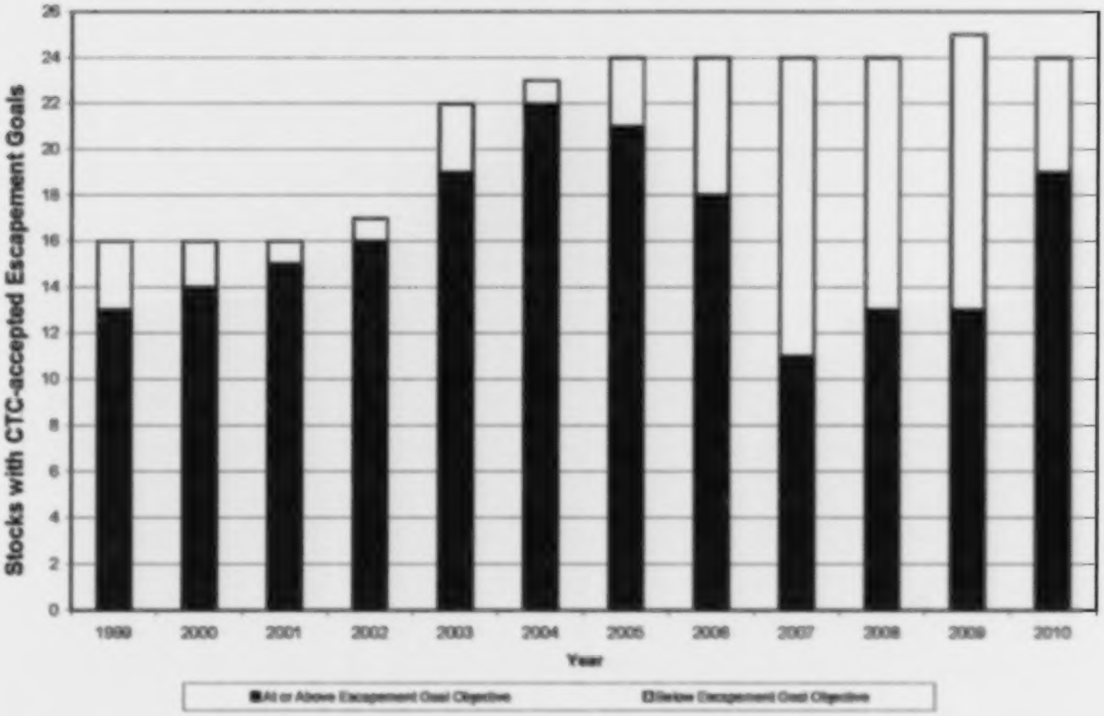


Figure 2.1 Number and status of stocks with Chinook Technical Committee accepted escapement goals for years 1999-2010.

2.3 Paragraph 13 Escapement Analysis

Paragraph 13 of the 2008 Agreement describes a process to implement additional management actions in AABM and ISBM fisheries if the management as prescribed in paragraphs 8 and 10 fail to meet MSY or other biologically-based escapement objectives. Paragraph 13 details a process for evaluating stock groups and indicator stocks listed in Attachments I-II to determine if additional management actions should be implemented in AABM fisheries. If additional management action is required, relevant ISBM fisheries for stocks also listed in Attachments IV and V would commensurately be reduced to increase the escapements of the depressed Chinook salmon stocks within the stock groups triggering the additional management actions. The CTC is to notify the Commission of any proposed fishery restrictions to be implemented under Paragraph 13 at the February Annual Meeting.

Additional management actions for SEAK or NBC AABM fisheries would reduce Table 1 catch limits by 10% if a majority of stocks with agreed management objectives in at least two of the stock groups listed in Attachment I and II of the Chinook salmon Annex were observed:

- at least 15% below their escapement goal management objectives for the past year and are forecast to be at least 15% below their escapement goal objectives in the upcoming year; or

- at least 15% below their escapement goal objectives for the past two consecutive years (unless a forecast for escapement will exceed the escapement objective in the coming year).

If three or more stock groups in Attachments I and II meet the criteria to trigger additional management action, Table 1 catch limits in the relevant AABM fishery would be reduced by 20%. For the WCVI AABM fishery, Attachment III of the 2008 Agreement lists stock groups applicable to the obligations defined in paragraph 13. However, in consideration of the 30% reduction in catch limits for the WCVI AABM fishery, the 2008 Agreement states that additional actions will not be taken for this fishery except as otherwise may be agreed by the Commission.

The 2008 Agreement directs the CTC to provide a review of Attachments I-V by 2014 or earlier, to determine if the current lists of stock groups continue to be appropriate, if there are new criteria that could be employed to revise stock group listings for each attachment, and whether any changes to the Attachments proposed by a Party may be appropriate. In the interim, the CTC in this report provides an evaluation of the stocks listed in Attachments I-III in relation to the criteria described in Paragraph 13.

In Table 2.3, the CTC summarizes the performance of the stock groups and the criteria for initiating additional management action in regards to Paragraph 13, based upon observed escapements and exploitation rates through 2010 and stock forecasts for 2011. For SEAK and NBC AABM fisheries, the stock groups in Attachment I and II are identical, and thus are combined in Table 2.3. All stocks relevant to Paragraph 13 decisions for SEAK and NBC AABM fisheries have escapement based management objectives. Although not meeting management objectives does not automatically trigger reductions in the WCVI AABM fishery, the CTC included an evaluation of the stock groups in Attachment III to inform the Commission of the performance of the stock groups in Attachment III in relation to the provisions of Paragraph 13. For the WCVI AABM fishery, stocks in the Puget Sound Summer/Fall stock group include three stocks with exploitation rate management objectives which have yet to be submitted for CTC review.

Table 2.3 Evaluation of criteria for initiating additional management action in regards to Paragraph 13 of the Chinook salmon Chapter of the Pacific Salmon Treaty 2008 Agreement. When the stock group cannot be evaluated because an insufficient number of stocks in the group have agreed escapement objectives, or that forecasts were not provided to the Chinook Technical Committee for stocks with agreed escapement objectives, NA is shown.

Fishery	**Stock Group**	**Stocks**	**Stocks with agreed objective**	**Number below threshold (2009 and 2010)**	**Stocks with a 2011 forecast**	**Number of 2011 forecasts below threshold**	**Paragraph 13 criteria met**
SEAK/ NBC	North/Central British Columbia	3	0	NA	0	NA	No
	Upper Strait of Georgia	5	0	NA	0	NA	No
	West Coast Vancouver Island Falls	7	0	NA	0	NA	No
	Far North Migrating Oregon Coastal Falls	3	3	1	3	0	No
	Columbia River Falls	3	3	0	2	0	No
	Columbia River Summers	1	1	0	1	0	No
	Washington Coastal Fall Naturals	5	3	0	0	NA	No
	Fraser Early (Spring & Summers)	3	0	NA	0	NA	No
WCVI	Columbia River Falls	3	3	0	0	0	No
	Fraser Late	1	1	0	0	NA	No
	Puget Sound Natural Summer/Falls	5	0	NA	0	NA	No
	Columbia River Summers	1	1	0	0	0	No

No stock groups listed in Attachment I-III met the criteria for triggering additional management action under Paragraph 13 for either the 2009 and 2010 observed values or the 2010 observed and 2011 forecast values (Table 2.3). However, the CTC could not evaluate if any of the stocks met the conditions in Paragraph 13(d), because harvest levels for ISBM fisheries were not yet available for 2010. Only one stock with an agreed escapement objective, the Nehalem in the NOC stock group, was more than 15% below the management objective in both 2009 and 2010. All stocks in the NOC stock group, including the Nehalem, are forecasted to be above the escapement goal in 2011 (Table 2.2).

Only five of the 10 different stock groups in Table 2.3 have stocks with agreed management objectives that can be evaluated for triggering additional management action. These five stock groups contain 13 stocks, of which 11 have agreed escapement objectives. Of the 11 stocks, forecasts for 2011 were available for six (Table 2.3). The CTC has identified a need to develop management objectives and forecast capabilities for more of the stocks included in Attachments I-III to improve the efficacy of the Paragraph 13.

This analysis was done well after the February timing required by the 2008 Agreement for the CTC to notify the Commission of any proposed fishery restrictions to be implemented under Paragraph 13 for the 2011 fishing season due to data availability. Much of the escapement data for 2010 and forecasts for 2011 were not provided until after June. Also, the CTC has not yet set the standards for precision and accuracy for forecasts and predictions used to develop Table 2.3. These data standards will be required before the evaluations that rely on forecasts can be used to recommend additional management action. However, the CTC has carried out the evaluation of the Paragraph 13 criteria, with the exception 13(d) and (e), to provide insight into current status of stocks in relation to the criteria and to identify data needs for the application of Paragraph 13. To meet the timing requirement for implementation of Paragraph 13, the CTC would need before the February Annual Meeting: a) escapement and exploitation rate estimates for the prior year for stocks included in Paragraph 13 Attachments I-V; and b) projections of exploitation rates and forecasts of escapements for the coming year for these same stocks.

As noted above, the Commission has assigned the CTC to review Attachments I-V and to provide recommendations on their use to the Commission. In its review, the CTC will consider the schedule of needed information for evaluation of the stock group criteria to determine how early in the annual cycle recommendations for additional management actions under Paragraph 13 can be provided to the Commission.

2.4 Trends and Profiles for Escapement Indicator Stocks

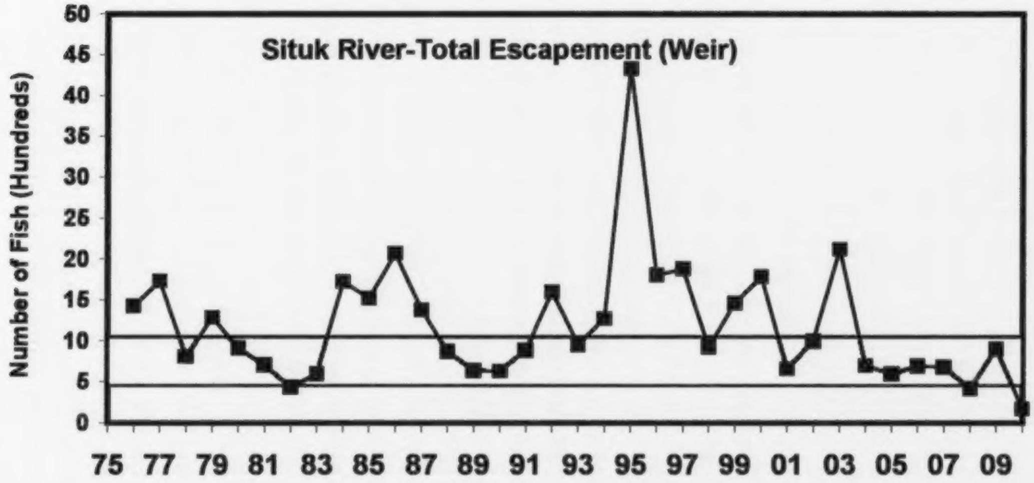
Graphs of time series of escapements and terminal runs for Chinook salmon stocks are included in sections for Alaska, Canada, and Washington/Columbia River/Oregon. Each graph contains the name of the stock and the type of data depicted (total escapement, index counts, terminal runs, etc.). A limited commentary is also provided for each stock. For the graphs that include estimates of the terminal run size, the harvests in terminal runs, in some cases, include both jacks and adults, whereas the escapement is usually reported in adults. The *x*-axis represents calendar years. All escapement goals accepted by the CTC are shown except for the LGS stock group because this group includes both the Cowichan and Nanaimo stocks and only the Cowichan has a CTC accepted goal. Historical escapement and terminal run data are provided for SEAK stocks in Appendix B.1, for Canadian stocks in Appendix B.2, for Puget Sound in Appendix B.3, Washington Coastal stocks in Appendix B.4, for Columbia River stocks in Appendix B.5 and Oregon Coastal stocks in Appendix B.6.

2.4.1 Southeast Alaska and Transboundary River Stocks

Of the 11 SEAK and TBR stocks included in the escapement assessment, the Situk, Chilkat, Taku, King Salmon, Stikine, and Unuk Rivers as well as Andrew Creek include estimates of total escapement of large fish, Chinook salmon ≥ 660 mm mid-eye to tail fork (MEF) length. In most systems these include 3-, 4-, and 5-ocean age fish and include almost all females and large males in the stocks; 1- and 2- ocean age males are not included in these estimates except those fish > 659 mm MEF. Escapement estimates for the Chickamin, Blossom, and Keta Rivers are index counts of large fish. These indices are enumerated from aerial helicopter surveys that represent a fraction (one-third to one-fifth) of the total number of large spawners. Except for the Chilkat River, survey methods have been standardized for all systems since 1975. The assessment of Chilkat River Chinook salmon was standardized in 1991 as an annual mark-recapture (MR) estimate of escapement. Escapement goals have been defined as a range for the SEAK/TBR stocks, shown by the grey shaded area on the graphs. Escapement estimates for the Alsek River are estimates of total escapement of age-1.2 fish and older.

The SEAK and TBR stocks can be classified into two broad categories, inside-rearing and outside-rearing, based on ocean migrations. Outside-rearing stocks have limited marine rearing in SEAK and are caught primarily during their return spawning migrations in the spring; these stocks include Chinook salmon returning to the Situk, Alsek, Taku, and Stikine Rivers. Inside-rearing stocks are vulnerable to SEAK and NBC fisheries as immature fish as well as during their spawning migrations and include the other seven SEAK and TBR indicator stocks. Note that there is some overlap in these stocks within these two broad classifications. All SEAK and TBR indicator stocks produce primarily yearling smolt except the Situk River, which presently produces primarily sub-yearling smolt. Sub-yearling smolts comprise about 10% of the annual runs in the Keta and Blossom Rivers.

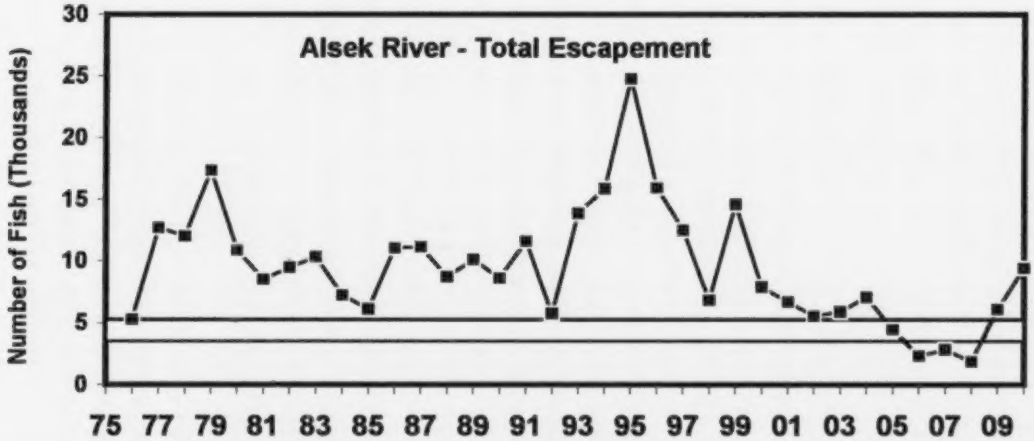
The Alaska Department of Fish and game (ADF&G) established a 15-year rebuilding program in 1981 (ADF&G 1981). ADF&G established interim point escapement goals in 1981 for all 11 systems, based on the highest observed escapement count prior to 1981. ADF&G (and CDFO for three TBR stocks) have subsequently revised escapement goals that have been reviewed and accepted by the CTC for all eleven stocks, some more than once. ADF&G uses escapement goal ranges in conformance with the ADF&G Salmon Escapement Goal Policy and Sustainable Salmon Fisheries Policy. These ranges are shaded in grey in graphs of escapements for the SEAK/TBR stocks.



Escapement Methodology: The Situk River is a non-glacial system located near Yakutat, Alaska, that supports a moderate-sized, outside-rearing stock of Chinook salmon. Escapements are based on weir counts minus upstream sport fishery harvests (if any), which are estimated from an on-site creel survey and a post season mail-out survey. The weir has been operated annually since 1976, and was also operated from 1928-1955. Counts of large Chinook salmon are reported as the spawning stock. Jacks (1- and 2-ocean-age fish) are also counted and, since 1989, jack counts (not included in the graph above) have ranged between 1,200 and 4,000 fish.

Escapement Goal Basis: In 1991, ADF&G revised the Situk River Chinook salmon escapement goal to 600 large spawners based upon a spawner-recruit analysis (McPherson 1991), which was reviewed and adopted by the CTC. In 1997, ADF&G revised the Situk River escapement goal range to 500-1,000 large spawners to conform to the department's escapement goal policy. The CTC reviewed and accepted this change in 1998. ADF&G changed the goal range to 450-1,050 large spawners in 2003; this range was reviewed by the CTC in 2004 but not accepted.

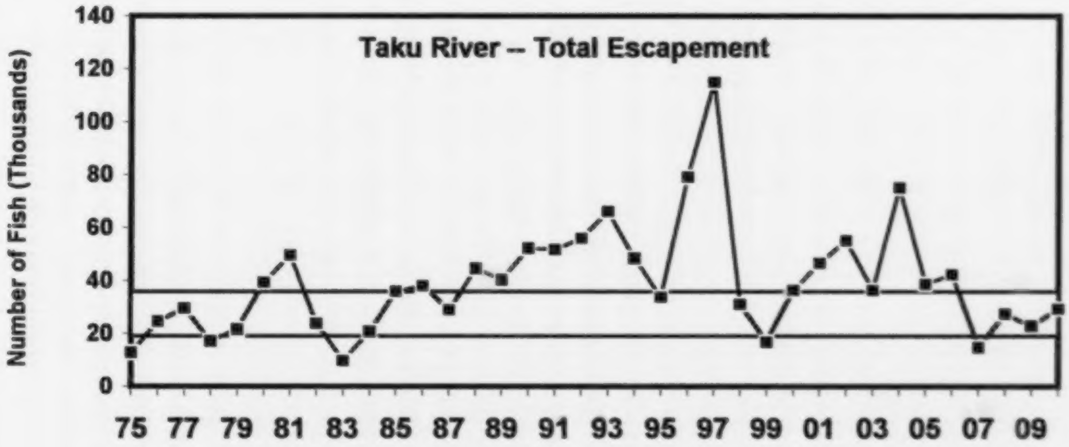
Agency Comments: During the 35-year period of 1976-2010, the Situk escapements have been below the goal range three times, in 1982, 2008 and 2010. Directed sport, commercial and subsistence fisheries located both inside the river and inlet and in nearby surf waters target this stock under a management plan to achieve escapements within the range. Total annual terminal catcht rates from all gear groups have averaged about 60% from 1990-2003. Catcht rates have been lower since 2004, as this stock has experienced poor survival for recent brood years. In 2010, the escapement was 167 large Chinook salmon, 33% of the lower end of the escapement goal range; however, the weir was out for a 3-day period and an undetermined number of spawners were not counted. Sport and commercial fisheries were restricted to non-retention of Chinook salmon in 2010.



Escapement Methodology: The Alsek River is large transboundary glacial system that originates in the SW Yukon Territory and NW British Columbia and flows into the Gulf of Alaska about 50 miles east of Yakutat. This river supports a moderate run of outside-rearing Chinook salmon. Since 1976 escapements have been principally monitored by a weir operated at the Klukshu River, one of 51 tributaries of the Tatshenshini River, the principal salmon-producing branch of the Alsek River. In previous reports, index escapements using a weir operated at the Klukshu River were presented for this stock. These have been replaced with estimates of total escapement, drainage-wide, including direct MR estimates for 1998-2004. All other years are Klukshu River weir counts expanded by the average expansion (4.00) factor from 1998-2004.

Escapement Goal Basis: During this cycle, a revised goal of 3,500 to 5,300 total spawners (fish age-1.2 and older) was accepted by the CTC, ADF&G, and Canadian Science Advisory Pacific, based on analysis in Bernard and Jones (2010). Prior to this, the goal was based on the escapement of fish through the Klukshu River weir (McPherson et al. 1998).

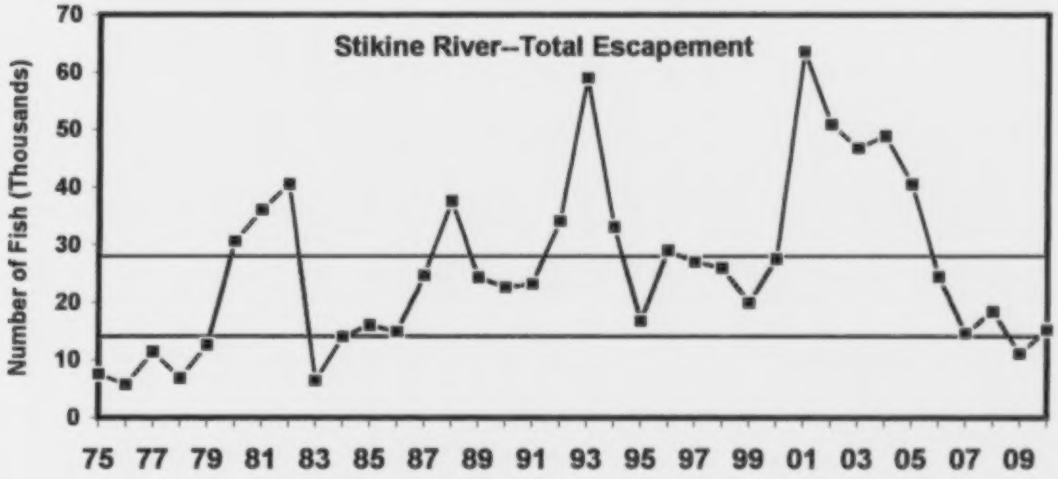
Agency Comments: Directed Canadian sport and aboriginal fisheries occur in various upriver sections of the Alsek River. Some Chinook salmon are caught as bycatch in the U.S. sockeye directed fishery that takes place inriver near the estuary and within the estuary. A few Chinook salmon are also caught in a U.S. subsistence fishery that takes place in the same area as the U.S. sockeye fishery. Total annual harvest rates have averaged 12% since 1976 (Bernard and Jones 2010). Escapements in the Alsek River have averaged 9,500 Chinook salmon over the 35-year period of 1976-2010. The 2010 escapement was 9,428 Chinook salmon based on the Klukshu weir count of 2,357 expanded by a factor of 4.0. The joint ADF&G-CDFO assessment is that the Alsek River stock is healthy but underutilized.



Escapement Methodology: The Taku River is a large, glacial, transboundary river that originates in northern British Columbia and flows into Taku Inlet east of Juneau, Alaska. This river supports a large, outside-rearing run of Chinook salmon. In 1989, 1990, and 1995-2010 escapements were estimated using MR methods. In other years since 1975, aerial counts were expanded by a factor of 5.2, the 5-year average of the ratio of the mark-recapture estimates to aerial survey counts (McPherson et al. 2010).

Escapement Goal Basis: During this cycle, a revised goal of 19,000 to 36,000 large Chinook salmon (age-.3 to -.5 fish) was accepted by the CTC, ADF&G, TBR Panel, and Canadian Science Advisory Pacific, based on the analysis in McPherson et al. (2010). Prior to this, the goal was based on the escapement of fish that optimized smolt production (McPherson et al. 2000).

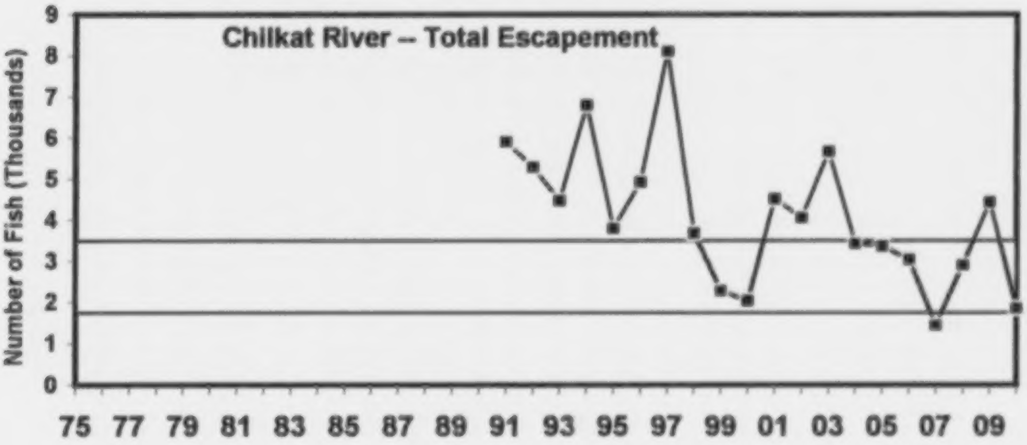
Agency Comments: Estimated harvest rates on this stock averaged 9.8% since 1973 (McPherson et al. 2010). In recent years of directed Chinook salmon fishing, total harvest rates on Taku River Chinook salmon were higher, 45% and 34% in 2005 and 2006.respectively. Most harvests occur in the U.S. commercial gillnet and sport marine fisheries in District 111 near Juneau and inriver in the Canadian gillnet and aboriginal fisheries that occur mostly just above the U.S./Canada border. Juvenile Chinook salmon were marked with CWTs from 1976 through 1981 and annually since 1993 (1991 brood). Data from recoveries of these CWTs from fisheries and inriver assessment projects provides the information needed for estimation of adult and smolt production. Since 1985, estimated escapements have been within or above the escapement goal range except in 1999 and 2007. In 2010, an estimated 29,307 large fish escaped into the Taku River and the joint ADF&G-CDFO assessment is that the stock is healthy.



Escapement Methodology: The Stikine River originates in British Columbia and flows into central Southeast Alaska near the towns of Petersburg and Wrangell. This is the largest river emptying into SEAK, glacial in origin, and supports a large, outside-rearing stock of Chinook salmon. From 1975 through 1984, index escapements were made using survey counts and since 1985, counts were made using a weir at the Little Tahltan River. Since 1996, MR experiments were conducted annually to estimate total escapement. These studies indicate the weir counts represented 17% to 20% of the total escapement (Pahlke and Etherton 1999).

Escapement Goal Basis: An escapement goal of 14,000 to 28,000 large Chinook salmon (age-.3 to -.5 fish) was established in 1999 after review and acceptance by the CTC, ADF&G, TBR Panel, and Canadian Science Advisory Pacific, based on the analysis in Bernard et al. 2000. Prior to this, several system-wide or index goals were developed by the U.S. and Canada and were based on limited data.

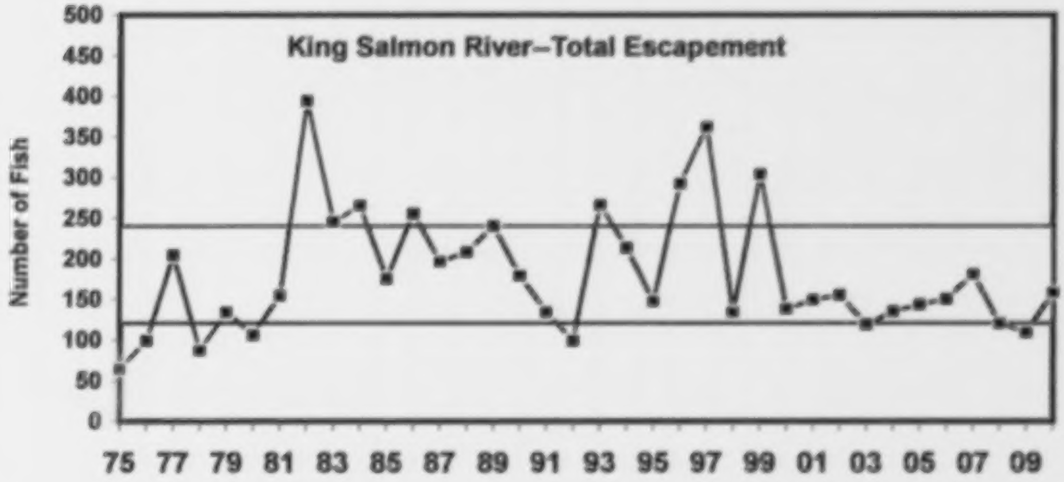
Agency Comments: In recent years of directed Chinook salmon fishing, total catch rates on Stikine River Chinook salmon are believed to have ranged between 50% and 70%. Most catches occur in the U.S. commercial gillnet and sport fisheries in District 108, near Petersburg and Wrangell, and inriver in the Canadian gillnet and aboriginal fisheries. CDFO and ADF&G currently operate joint programs to CWT smolt in order to estimate smolt and adult production, as well as exploitation. Since 1985, escapements to the Stikine River were within or above the escapement goal range except in 2009. In 2010, an estimated 15,177 large fish escaped into the Stikine River and the joint ADF&G-CDFO assessment is that the stock is healthy.



Escapement Methodology: The Chilkat River is a moderate-sized glacial system located near Haines, Alaska which supports a moderate-sized, inside-rearing stock of Chinook salmon. Escapements are based on estimates of large spawners from a MR program annually since 1991 (Ericksen and McPherson 2003). The escapement database for this stock since 1991 is relatively precise, with coefficients of variation for annual escapements averaging 15%. From 1975-1992, aerial survey counts were conducted on two small tributaries with relatively clear water; results from these estimates were inconsistent. Radio telemetry studies conducted in 1991 and 1992 found that spawners in these two tributaries represented less than 5% of the total escapement, and did not represent trends in abundance, so aerial surveys were discontinued.

Escapement Goal Basis: The 1981 escapement goal was set at 2,000 large fish, based on an assumed fraction of the total escapement represented by discontinued survey counts. In 2003, a revised escapement goal range of 1,750 to 3,500 large Chinook salmon spawners was recommended, based on the MR estimates of escapement and limited CWT information available for this stock (Ericksen and McPherson 2003) . This goal range was reviewed and adopted by ADF&G and the Alaska Board of Fish in 2003 and subsequently reviewed and accepted by the CTC.

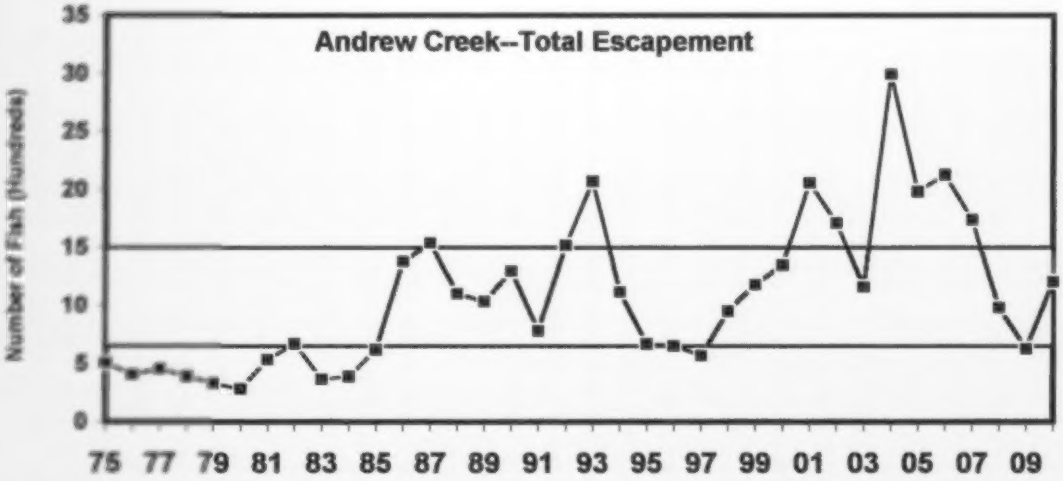
Agency Comments: Smolt from this stock have been CWTd at relatively high rates (8-10%) beginning with the 1999 brood year; additional wild-stock tagging occurred for 3 broods prior to that time. Relatively small terminal U.S. marine sport and subsistence fisheries target this stock. This stock is also caught incidentally in SEAK sport, commercial drift gillnet and troll fisheries in northern SEAK. Available CWT information on this stock suggests that exploitation is about 20% for recent brood years from the CTC ERA. Escapements since 1991 have been within or above the escapement goal range in all years except 2007. The preliminary escapement in 2010 was estimated at 1,852 large spawners, near the lower end of the escapement goal range.



Escapement Methodology: The King Salmon River is a small non-glacial system located on Admiralty Island southeast of Juneau that supports a small, inside-rearing stock. Escapements of large Chinook salmon are based upon weir counts from 1983-1992 and expansions of survey counts from 1971 to 1982 and 1993 to 2010. A weir was operated for 10 years (1983-1992) along with the surveys and, on average the total escapement was 1.52 times the survey count (McPherson and Clark 2001). Jacks (2-ocean-age fish) represented an average of 22% of the weir counts from 1983-1992 and are not included in the graph above.

Escapement Goal Basis: In 1981, ADF&G set the index goal at 200 large fish based upon peak survey counts of 200 spawners in 1957 and 211 spawners in 1973. In 1997, ADF&G revised the goal to 120-240 total large fish based upon a spawner-recruit analysis for the 1971-1991 brood years (McPherson and Clark 2001). The analysis and goal range was accepted by the CTC in 2001.

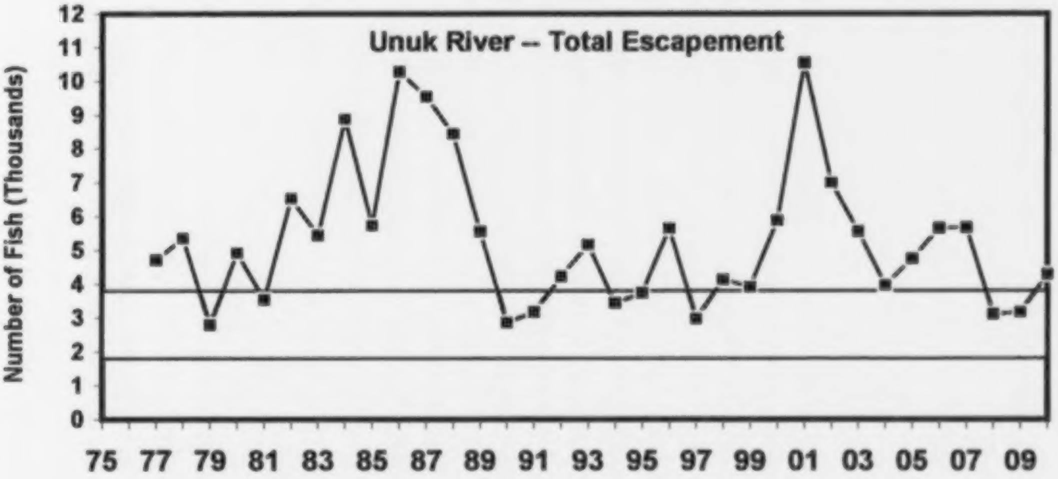
Agency Comments: There is no terminal fishery targeting this stock, though harvests of immature and mature fish occur in SEAK fisheries. Since 1981, escapements have been within or above the accepted range except in 1992 and 2009. The estimated escapement in 2010 was 158 large spawners. Survey conditions in 2010 were noted as normal.



Escapement Methodology: Andrew Creek, near Petersburg, Alaska, is a small non-glacial U. S. tributary of the lower Stikine River that supports a moderate run of inside-rearing Chinook salmon. Escapements are based upon weir counts from 1976 to 1984 and expansions of index counts in 1975 and 1985 to 2010. Four years of concurrent weir and index count data were used to estimate the expansion factor of 1.95. Jacks have represented an average of 19% of the weir counts and are not included in the above graph.

Escapement Goal Basis: In the early 1980s, ADF&G set the Andrew Creek Chinook salmon escapement goal at 750 large fish (total escapement). In 1997, an initial stock-recruit analysis was developed that underwent review by ADF&G and the CTC. This analysis was completed in 1998 and the technical report (Clark et al. 1998) recommended a revised biological escapement goal range of 650 to 1,500 large Chinook salmon that was accepted and adopted by the ADF&G and the CTC.

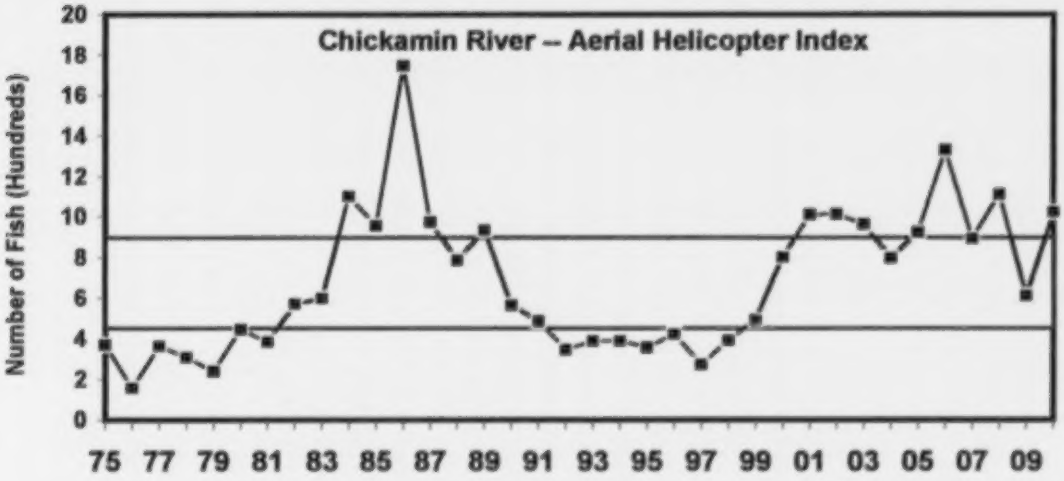
Agency Comments: Before 1976 a large terminal marine gillnet fishery occurred in the spring, targeting Stikine River and other nearby Chinook salmon stocks. Harvests of immature and mature fish Andrew Creek occur primarily in SEAK and to a small extent in NBC fisheries, based on CWT recoveries of Chinook salmon from SEAK hatcheries using Andrew Creek brood stock. Escapements since 1986 have all been above the lower end of the biological escapement goal range of 650 to 1,500, except in 1997 and 2009 when they were < 5% below the range. The estimated escapement in 2010 was 1,205 large spawners, within the upper half of the range.



Escapement Methodology: The Unuk River is a moderate-sized glacial system that supports a moderate run of inside-rearing Chinook salmon. Escapements are estimates of total escapement of large spawners. The estimates are based on MR estimates from 1997 to 2010 and expanded survey counts from 1977 to 1996. Radio telemetry studies in 1994 and 2007 showed that the surveys are conducted in stream reaches where 80% of the spawning occurs; the expansion factor for survey counts is 4.83 (Hendrich et al. 2008).

Escapement Goal Basis: In 1994, ADF&G revised the Unuk escapement goal to 875 large spawners in survey (index) counts, based upon the spawner-recruit analysis reported by McPherson and Carlile (1997), which the CTC reviewed and accepted in 1994. In 1997, ADF&G revised the goal to a range of 650-1,400 large index spawners as recommended in the McPherson and Carlile (1997) report and in compliance with the ADF&G Escapement Goal Policy. The CTC reviewed and accepted this change in 1998. Since the expansion factor for surveys was unknown at that time, the goal was expressed in survey count currency. In 2008, a more extensive analysis was done with spawners, recruitment and fishing mortality expressed in total numbers of fish because of the extensive number of MR estimates of escapement and CWT data available (Hendrich et al. 2008). The analysis included the 1982-2001 brood years. The CTC accepted a range of 1,800 to 3,800 large spawners, with a point estimate of 2,764, in 2009.

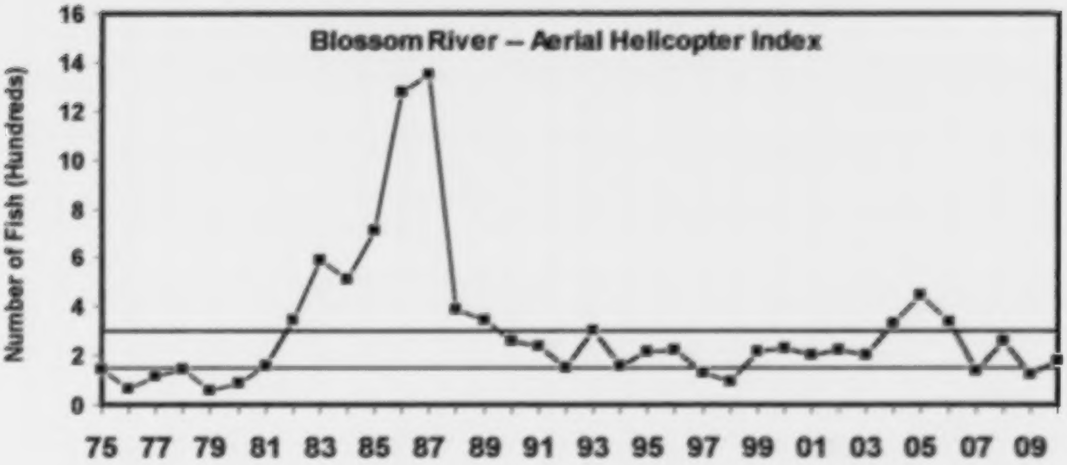
Agency Comments: Catches of immature and mature fish occur in SEAK and NBC fisheries. On average, for the 1992-2001 broods, catch by gear sector was 47% SEAK troll, 36% SEAK sport, 10% SEAK net and most of the remainder caught in NBC. About 55% of the catch is taken in the southern inside area of SEAK (mostly troll and sport). Estimated annual catch rates averaged about 27% in nominal numbers and 24% in AEQs from 1985 to 1998 (Hendrich et al. 2008). Coded-wire tagging of this stock was conducted for the 1982–1986 (Pahlke 1995) and the 1992–present broods; this stock is now an exploitation rate indicator stock. In the 34 years since 1977, the estimated escapements have been within or above the escapement goal range each year. The estimated escapement in 2010 escapement was 4,290 large spawners, slightly above the escapement goal range.



Escapement Methodology: The Chickamin River is a moderate-sized glacial system that supports a moderate run of inside-rearing Chinook salmon, based on wild-stock CWTs. Reported escapements shown above are survey counts (unexpanded highest single-day counts) of large fish in eight tributaries using standardized methodology (Pahlke 2003). MR studies in 1995, 1996 and 2001-2005 found that about 21% of the total escapement is counted during peak surveys on average (Weller et al. 2007). A radio telemetry study in 1996 indicated that the annual surveys are conducted in stream reaches where over 80% of all spawning occurs. The expansion factor is estimated at 4.75 for survey counts using the results from the 1996 and 2001-2005 studies.

Escapement Goal Basis: In 1994, ADF&G revised the goal to 525 large index spawners based upon a spawner-recruit analysis (McPherson and Carlile 1997), which the CTC reviewed and accepted. In 1997, ADF&G revised the goal to 450-900 large index spawners as recommended in the McPherson and Carlile (1997) report and in compliance with the ADF&G Escapement Goal Policy (ADF&G 1997). The CTC reviewed and accepted this change in 1998.

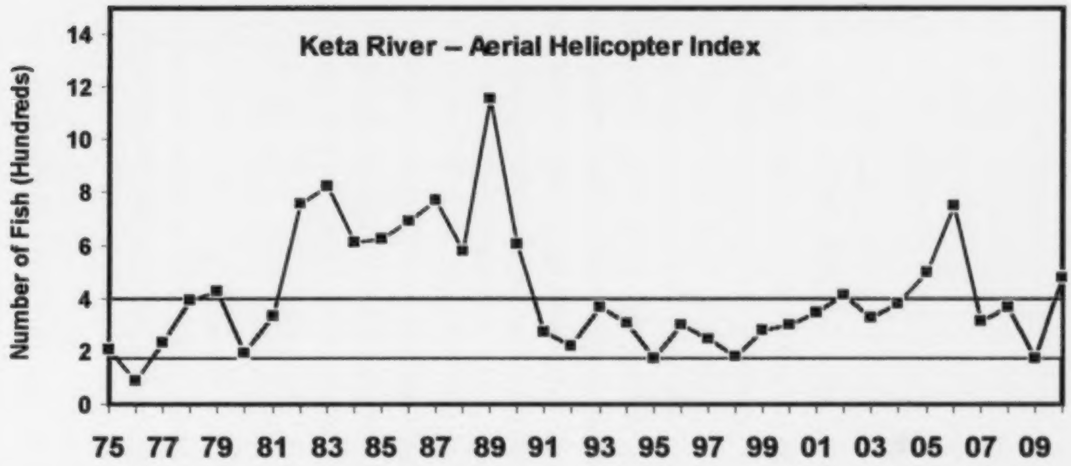
Agency Comments: There is no terminal fishery targeting this stock; immature and mature fish are caught in marine SEAK and NBC fisheries, with the majority taken in the southern inside quadrant of SEAK by troll and sport gear sectors. There are no subsistence or freshwater fisheries on any Behm Canal Chinook salmon stocks. Coded-wire tagging was conducted for the 1982-1986 broods (Pahlke 1995) and resumed for the 2000-2006 broods. Estimated total exploitation rates for recent broods are about 28-30% in AEQs under the current management regime. Like the nearby Blossom and Keta Rivers, this stock produces the largest fish at age in SEAK. The time series of survey counts follows 2 cycles: counts for 1975-1981 and 1992-1998 were below the goal range, and those from 1982-1991 and 1999-2010 were all within or slightly above the range. Survey counts since 1999 have averaged 953 large spawners. In 2010, the survey count was 1,023, which is about 10% above the range and represents an estimated total escapement of 4,894 large spawners.



Escapement Methodology: The Blossom River is a small-sized non-glacial system that supports a small run of inside-rearing Chinook salmon and empties into Behm Canal near Ketchikan. Indices of escapement since 1975 are peak single-day survey counts of large spawners, standardized since 1975 in area and time (Pahlke 2003). Studies using MR were performed in 1998 and in 2004–2006, in addition to the survey counts. The agency agreed expansion factor is 3.87 for years without MR estimates.

Escapement Goal Basis: In 1994, ADF&G revised the Blossom River goal to 300 large index spawners based upon a spawner-recruit analysis (McPherson and Carlile 1997), which the CTC reviewed and accepted. In 1997, ADF&G revised the goal to a range of 250-500 large index spawners in conformance with the McPherson and Carlile (1997) report and in compliance with the ADF&G Escapement Goal Policy. The CTC reviewed and accepted this change in 1998. In 2010, the ADF&G submitted a report to the CTC with a revised goal of 150-300 large index spawners. The CTC accepted the revision in June 2011.

Agency Comments: There is no terminal fishery targeting this stock; immature and mature fish are caught in SEAK and NBC fisheries, based on wild-stock and hatchery-stock data from the nearby Unuk and Chickamin Rivers. All waters of east Behm Canal are closed to Chinook salmon fishing year-round. Age data collected since 1998 indicate that about 10% of the annual run is comprised of progeny from under-yearling smolt. Between 1976 and 1980, survey counts were below the current escapement goal, averaging 93 large fish. These smaller escapements subsequently seeded large runs with resultant large escapements during the six-year period of 1982-1987, with counts averaging 796 fish. This six-year period of larger escapements has been followed by a 23-year period (1988-2010) of reduced, but relatively stable, spawning abundance averaging 234 large fish in survey counts. The 2010 survey count of 180 large spawners was within the escapement goal range. Survey counting conditions were noted as normal for this system in 2010.



Escapement Methodology: The Keta River is a small-sized non-glacial system southeast of Ketchikan that supports a small run of inside-rearing Chinook salmon. Indices of escapement since 1975 are peak single day survey counts of large spawners, standardized since 1975 in area and time (Pahlke 2003). Total escapement was estimated with MR methodology in 1998, 1999, and 2000 (Freeman et al. 2001). The estimated expansion factor for survey counts is 3.01.

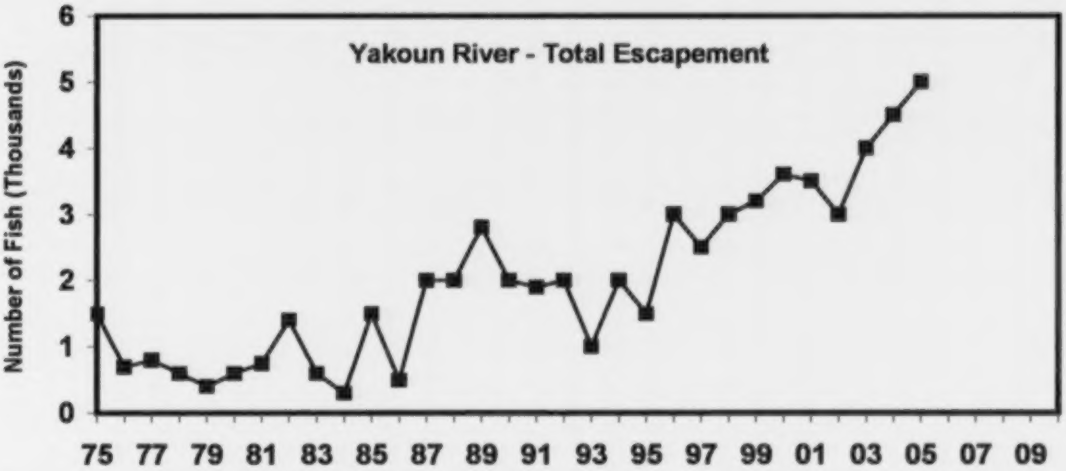
Escapement Goal Basis: In 1994, ADF&G revised the escapement goal to 300 large index spawners based upon a spawner-recruit analysis (McPherson and Carlile 1997), which the CTC reviewed and accepted in 1994. In 1997, ADF&G revised the escapement goal to a range of 250-500 large index spawners in conformance with the McPherson and Carlile (1997) report and in compliance with the ADF&G Escapement Goal Policy (ADF&G 1997). The CTC reviewed and accepted this change in 1998. In 2010, ADF&G submitted a report to the CTC with a revised goal of 175-400 large index spawners. The CTC accepted the revision in June 2011.

Agency Comments: There is no terminal fishery targeting this stock; immature and mature fish are caughtin SEAK and NBC fisheries, based on wild-stock and hatchery-stock data from the nearby Unuk and Chickamin River. All waters of east Behm Canal are closed to Chinook salmon fishing year round. Age data collected since 1998 indicate that about 10% of the annual run is comprised of progeny from under-yearling smolt. Like the nearby Blossom River, survey counts were low in the 1970s, rose in the mid to late 1980s and have been relatively stable since that time. Between 1975 and 1981, annual survey counts were within or below the goal of 250-500, averaging 265 large spawners. Production from the 1975-1981 escapements was high and survey counts from 1982 to 1990 averaged 734 large fish. This was followed by a 20-year period (1991-2010) of relatively stable survey counts, averaging 332 large spawners. The survey count in 2010 was 475 large spawners, under normal counting conditions, which is above the upper end of the escapement goal range.

2.4.2 Canadian Stocks

Since the beginning of the Chinook salmon rebuilding program of the 1985 PST, escapement goals for Canadian Chinook salmon stocks were generally based on doubling the average escapements recorded from 1979-1982. The doubling was based on the premise that Canadian Chinook salmon stocks were over-fished and that doubling the escapement would still be less than the optimal escapement estimated for the aggregate of all Canadian Chinook salmon populations (see stock-recruitment curve in "Technical Basis of PSC Catch Ceilings," Figure 1, Attachment 4, PSC file 72006; PSC Office, Vancouver, BC). Doubling was also expected to be a large enough change in escapements to allow detection of the change in numbers of spawners and the subsequent production. The escapement goals of the Canadian stocks are currently being reviewed.

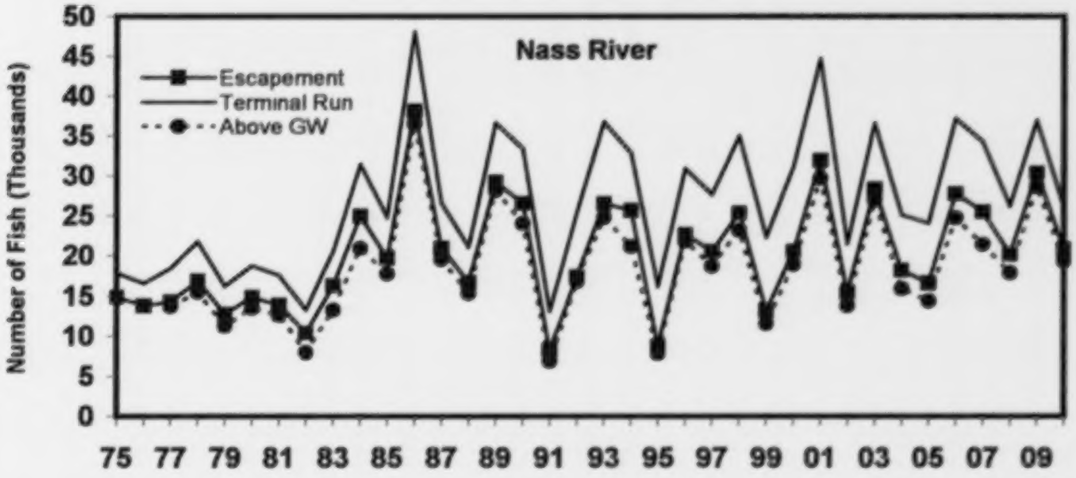
2.4.2.1 Northern British Columbia



Escapement Methodology: The Yakoun River is the only significant Chinook salmon-producing stream on Haida Gwaii (the Queen Charlotte Islands). Chinook salmon spawn primarily at the outlet of Yakoun Lake and are a summer-run stock. Visual estimates of escapement were made by foot surveys of the system. These estimates were then expanded into a total estimate of spawning escapement in the system. The effort spent on escapement surveys declined since 2005 and the survey's accuracy (i.e. ability to estimate the actual escapement) was unknown. Escapement estimates are thought to have exceeded 5,000 Chinook salmon since 2005. However the time series has not been continued.

Escapement Goal Basis: There is no CTC accepted escapement goal for this stock.

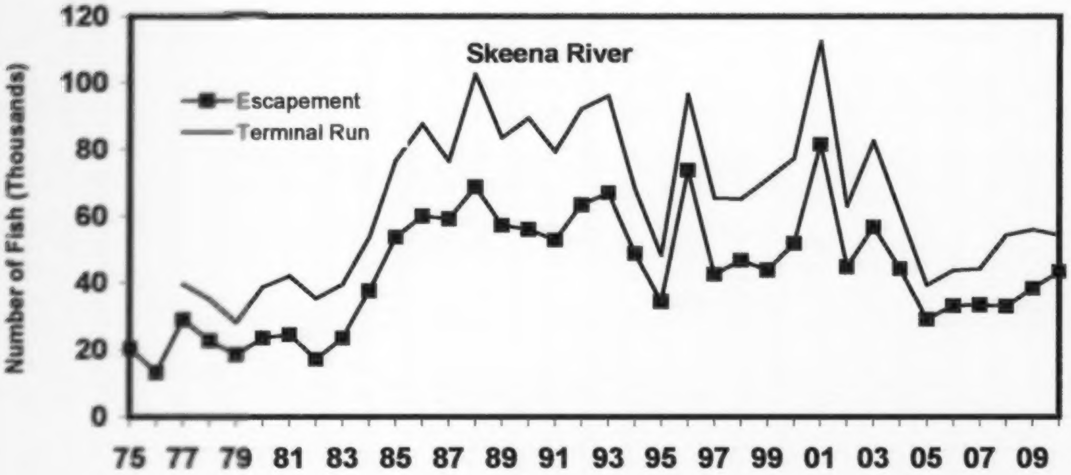
Agency Comments: A small enhancement program exists on the Yakoun River.



Escapement Methodology: The Nass River is the largest river in Area 3, representing a group of approximately 25 streams in Area 3. Prior to 1992, CDFO observations of escapement were based on visual counts. Programs using MR have been conducted since 1992 by the Nisga'a Fisheries to estimate total spawning escapement in the Nass River. The Nass MR program uses two fish wheels at Gitwinksihlkw (GW) in the lower Nass canyon to apply tags and two wheels at Grease Harbor in the upper canyon and the Meziadin River fishway for recovery. A modified Petersen model was used to estimate the total population of Chinook salmon past the tagging location. Tags were also recovered in upriver fisheries and on the spawning grounds. Spawning escapements were calculated as the estimated Chinook salmon population past GW from the MR studies, less upriver catches in sport and FN fisheries. Three tributaries with Chinook salmon populations enter the Nass River below GW. Visual estimates augmented by fence counts of the Kincolith River in 2001, 2002, 2005 and 2007 were used to estimate Nass River Chinook salmon escapements below the fish wheels.

Escapement Goal Basis: There is no CTC accepted escapement goal for this stock. The Fisheries Operational Guidelines states two goals for managing fisheries: an operational target escapement of 20,000 Chinook on the spawning grounds, and a minimum escapement of 10,000 Chinook. If escapements are projected to be below 10,000 Chinook, then no fishing on Nass River Chinook would be recommended. No biological-basis for an escapement goal has been developed for this system.

Agency Comments: The Nisga'a Fisheries Working group, including CDFO, has accepted the historical escapement and terminal run values. These figures have been revised and are presented in Appendix B2. Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for stocks within the Nass River stock group (Parken at al.2006), but estimates of total escapement are needed to make them effective. The SSP at the Nass River (Section 3.1.5.3) and Northern Endowment Funded projects at the Kwinamass and Kateen Rivers will help evaluate spawner levels relative to estimates of S_{MSY} and other reference points

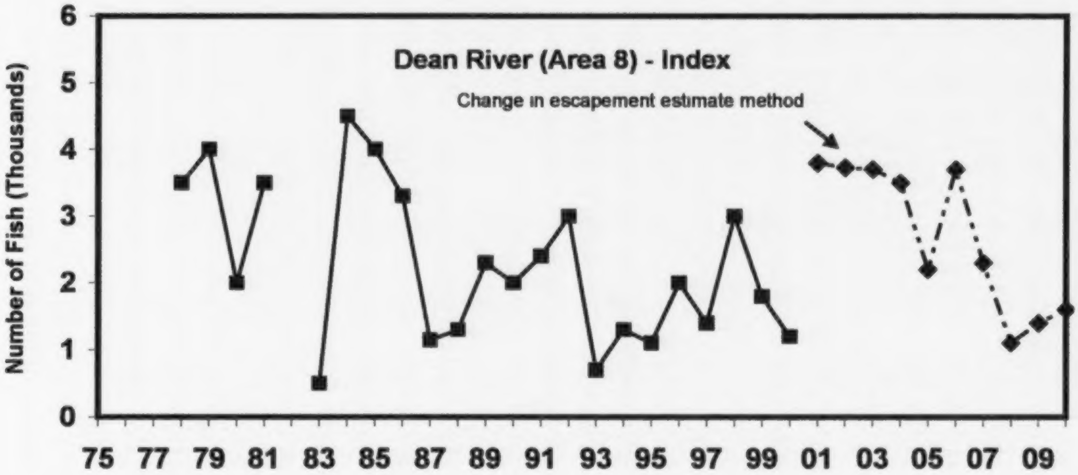


Escapement Methodology: The Skeena Chinook salmon escapements shown above represent 40 streams within the Skeena watershed which are consistently surveyed. The Skeena River supports over 75 separate Chinook salmon spawning populations, but three (Kitsumkalum, Morice, and Bear Rivers) account for about 70% of the total abundance. A second group of populations (Ecstall, Kispiox, and Babine Rivers) have annual returns ranging from 1,000 to 5,000 spawners, and comprise about 13% of Skeena returns. Escapement estimates are generally based on visual observations from helicopter, fixed wing aircraft and/or from stream walking surveys. Fish counting weirs are present on the Babine, Sustut and Kitwanga Rivers. The Kitsumkalum River is the exploitation rate indicator stock for the Skeena Chinook salmon complex. Spawning escapements in the Kitsumkalum have been estimated using a MR program since 1984.

Escapement Goal Basis: There is no CTC accepted escapement goal for this stock. Biologically-based goals for this complex of Chinook salmon spawning populations have not yet been developed. Future assessments will partition this large aggregate into stocks by run timing, life history and geographic areas.

Agency Comments: Terminal fishery in the Skeena River would normally include commercial gillnet in the terminal exclusion area (River Gap Slough, Area 4), in-river sport, and aboriginal fisheries. Estimates of in-river sport catch were not available from 1997 to 2002. A creel survey was conducted on the Lower Skeena in 2003 and 2010. Consequently, the 2003 and 2010 total terminal run estimates include lower river sport catch but no estimate of upper river sport catch. Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for stocks within the Skeena River, but estimates of total escapement are needed to make them effective. There are two SSPs on the Skeena River (see Sections 3.1.5.1 and 3.1.5.2) that will provide estimates of total escapement for the Skeena River and its component tributaries.

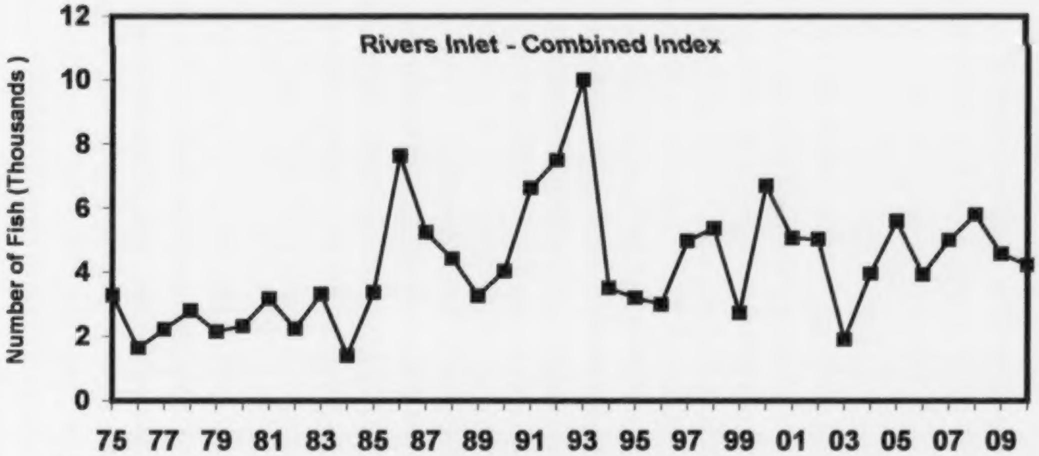
2.4.2.2 Central British Columbia

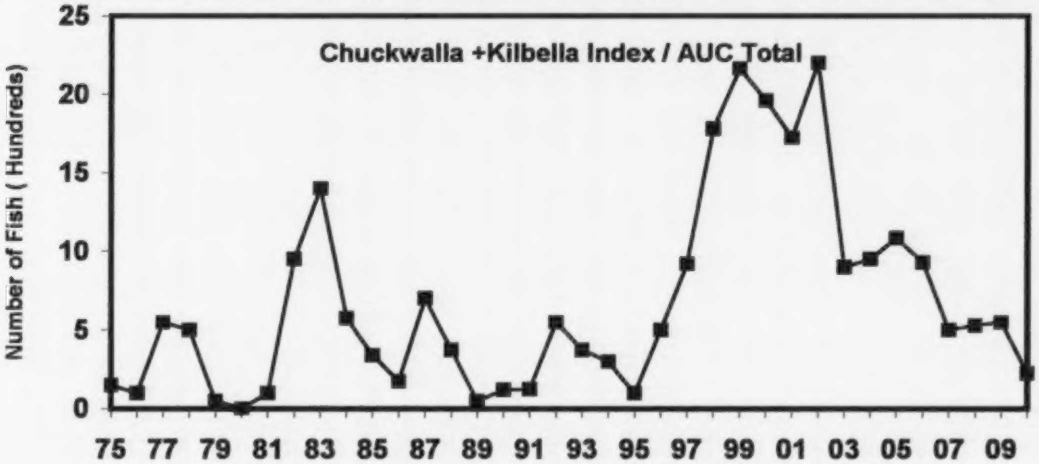


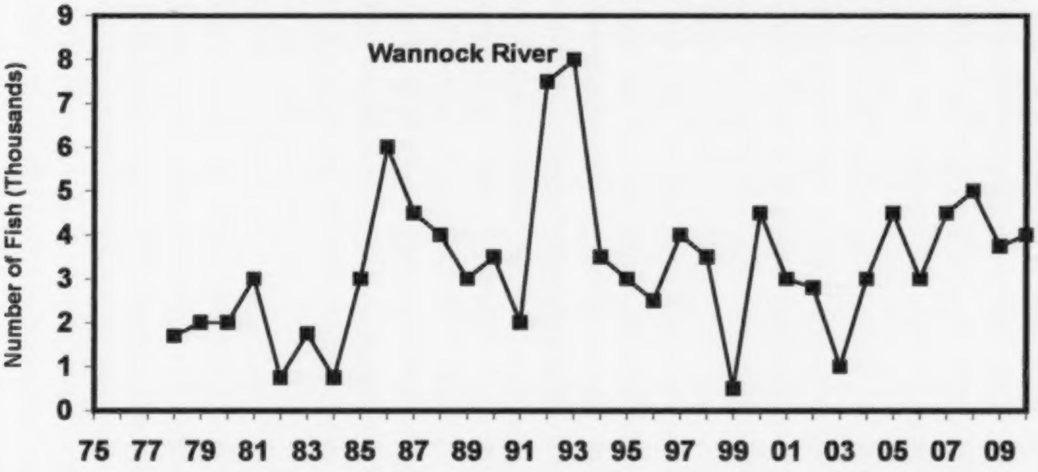
Escapement Methodology: The Area 8 Chinook salmon stock consists of seven non-enhanced systems, but the Dean River is the main spawning population. Of all Chinook salmon-producing streams in Areas 5 to 10, the Dean is the best indicator in terms of consistent survey coverage and methodology. Chinook salmon returning to the Dean River have early-summer timing and most spawn in the lower river by July. Up until 2000, counts of spawning Chinook salmon were made during 1-3 surveys and the peak count used as the escapement index. Survey counts were sometimes expanded to account for sections of the river that could not be surveyed in any year, but the counts were not extrapolated to total escapement of Chinook salmon to the river. Since 2001, the annual number of aerial surveys has increased, allowing the calculation of Area-Under-the-Curve (AUC) escapement estimates. In some years viewing conditions were poor and did not result in counts necessary to produce an AUC estimate. In these years maximum likelihood estimates were used to produce estimates as was the case in 2004 (3,500). A Chinook salmon MR program was initiated on the Dean River in 2006 to generate expansion factors for converting the current spawner indices (AUC estimates from helicopter flights) into estimates of total escapement. The preliminary estimate of escapement based on the MR program was 5,478 in 2006 compared to the maximum likelihood estimate of 3,689. For the purposes of this report however, the index of escapement is reported in the figures. In line with this methodology, an AUC estimate of 1,600 Chinook salmon was derived for the Dean River in 2010.

Escapement Goal Basis: There is no CTC accepted escapement goal for this stock. Biologically-based goals for this complex of Chinook salmon spawning populations have not yet been developed. Future assessments will partition this large aggregate into stocks by run timing, life history and geographic areas.

Agency Comments: Based on the large contribution of the Dean River to Area 8 escapements and due to gaps in the escapement data for other streams in Area 8, the Dean River alone is used to represent stock trends in Area 8. Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for the Dean River, but estimates of total escapement are needed to make them effective.





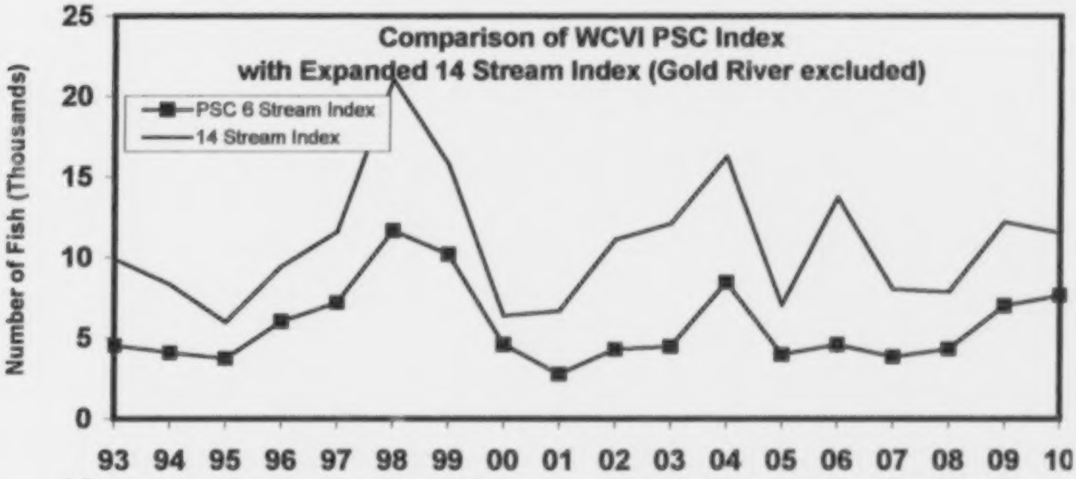


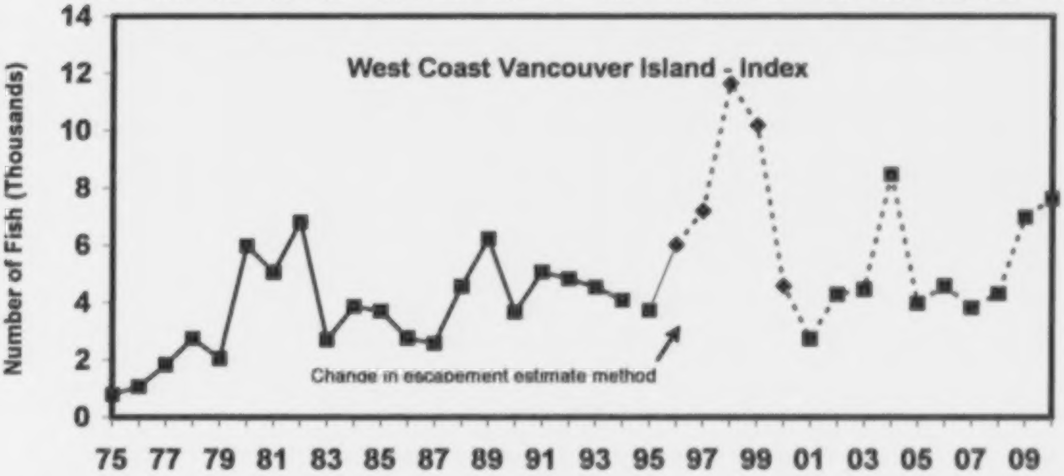
Escapement Methodology: The Rivers Inlet escapement indicator aggregate consists of the Wannock Conservation Unit (CU) and the Rivers Inlet CU, each recognized under Canada's Wild Salmon Policy. The largest contributor to the production of the Rivers Inlet combined index is the Wannock CU, which represents an average of 76% of the production for this index over the past ten years. More recently, however, this has risen to an average of 91% for the period of 2007-2010.Wannock Chinook salmon have been shown to be distinct from other populations in the central coast of British Columbia based on salmon microsatellite DNA analysis. This ocean-type stock exhibits fall run timing and is renowned for its large size at return. The Wannock River drains Owikeno Lake, is about six kilometers long, and is wide and turbid. Assessment methodologies consist of an annual carcass recovery program which provides an index of abundance. Index estimates are derived by expanding the number of carcasses pitched based on a number of factors which include river clarity, river height, and recovery effort. Estimates are somewhat subjective and a program to calibrate this index with a statistically-derived population estimate using traditional MR experiments was conducted from 1991-1994. Results suggest the index of escapement is an underestimate of the true Wannock population. Indices have ranged from 500 in 1999 to 8,000 in 1993. From 1990-2010, the average index was 3,700.

Escapement Goal Basis: The low escapement recorded in 1999 led to restrictions in the terminal Rivers Inlet sport fishery which is believed to be the largest single harvester of Wannock Chinook salmon. These sport fishery restrictions, which remain in effect, include a terminal closed area, a downrigger ban, and a restriction on the use of attractors. There is no current CTC accepted escapement goal for the Wannock or Chuckwalla/Killbella stocks. Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for these stocks, but estimates of total escapement are needed to make them effective. Also, it is unclear if the habitat-based escapement goals are reasonable given the unique characteristics of the Wannock River (Parken et al. 2006).

Agency Comments: The remaining Chinook salmon populations in Rivers Inlet have been grouped into a unique CU based on differing genetic and life history traits. These stocks which are spring-run, smaller at return, and stream-type, are found in the Rivers Inlet CU. This CU includes the Owikeno Lake tributary stocks (Amback, Ashlulm, Dallery, Neechanz, Sheemahant, Tzeo and Washwash, as well as the Clyack River which flows into Moses Inlet and the Chuckwalla and Kilbella Rivers which flow directly into Rivers Inlet). Only Chuckwalla and Kilbella Chinook salmon stocks are included in the Rivers Inlet combined index as they are assessed annually and make up the majority of production for this stock group. Escapements for the Chuckwalla and Kilbella are estimated using Area-Under-The-Curve methodology which is typically based on a series of four helicopter flights spaced over the Chinook salmon spawning period. Enhancement efforts were conducted on these systems from 1990 to1998 and the corresponding production can be observed in the escapement graph for the years 1994 through to 2003. Estimated returns for the Chuckwalla and Kilbella combined averaged 1300 Chinook salmon during the period of enhanced returns. Subsequent returns during the post-enhancement period of 2004 through to 2010 have decreased to an average of 760 and the estimated combined return in 2010 was one of the lowest in recent history at 225. It is unclear if this CU is merely returning to pre-enhancement levels or is experiencing an unrelated decline. Given the significant differences in life history and genetic makeup between stocks within the Rivers Inlet combined index it is advisable to assess them on an individually. There is no CTC accepted escapement goal for either of the Chinook salmon CUs within the Rivers Inlet combined index.

2.4.2.3 West Coast Vancouver Island and Georgia Strait

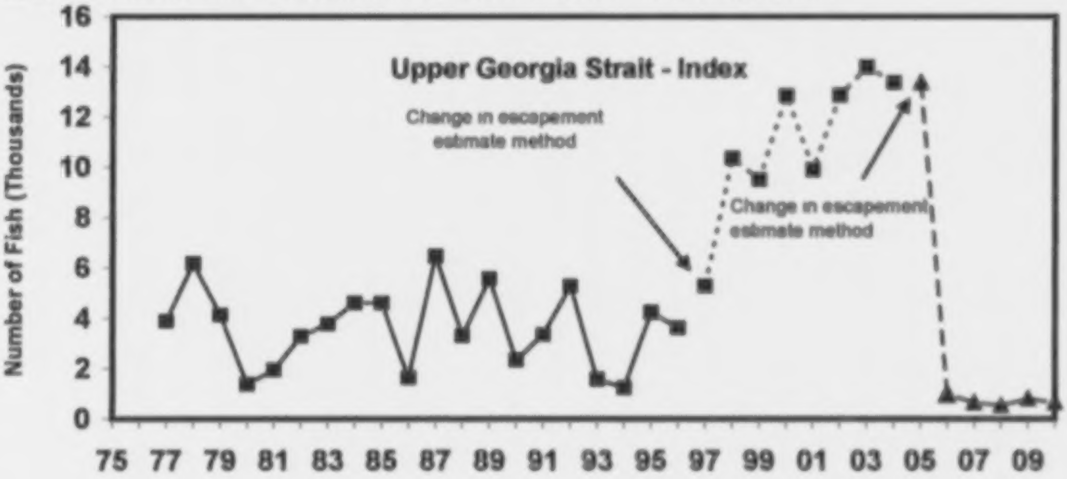




Escapement Methodology: The WCVI index represents the sum of escapements for six rivers (Marble, Tahsis, Burman, Artlish, Kaouk, and Tahsish), which were chosen to provide an 'index' of escapement for wild WCVI stocks in general. These stocks were chosen based on historical consistency of data quality. CDFO has developed a 14-stream expanded index which includes escapements to the six stream index plus the following WCVI streams: Colonial/Cayegle Creeks (Area 26), Leiner (Area 25), Megin, Bedwell/Ursus, Moyeha (Area 24) and Sarita, Nahmint (Area 23), and San Juan (Area 21). In 2005, the Colonial/Cayegle escapement was not available, and was therefore not included in the 14-stream index. Since 2007, a MR program has been conducted on the Burman River, a SSP (Section 3.1.3.2), in addition to the regular swim and foot surveys. However, the escapement estimate used for the index followed the same methodology since 2005.

Escapement Goal Basis: There is currently no CTC accepted escapement goal for this stock group.

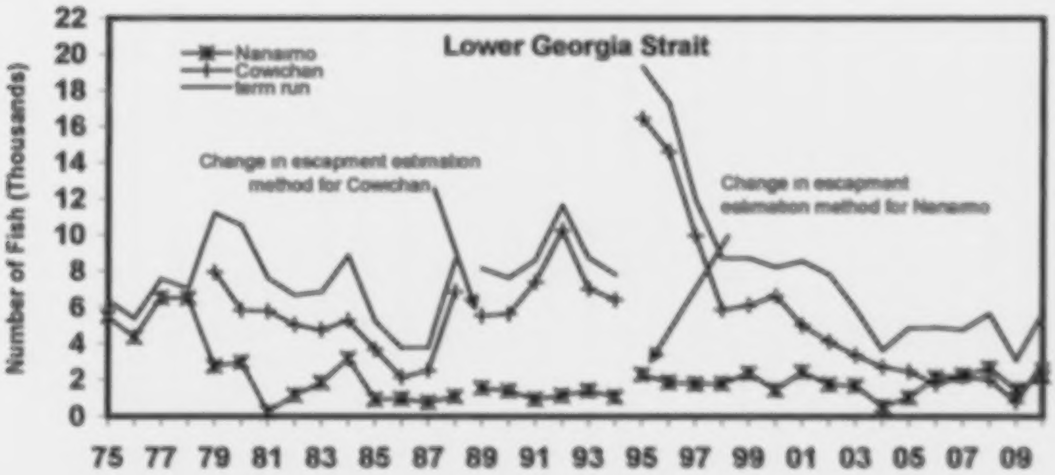
Agency Comments: Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for these stocks (Parken et al. 2006), but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements as part of the SSPs at the Burman, Moyeha, and Kaouk Rivers (Section 3.1.3). WCVI Chinook salmon have remained below the agency goal for these streams since 1999 despite terminal fishing closures in effect in Areas 24-26 in July each year and efforts to conserve WCVI Chinook salmon in Canadian fisheries. Escapements to all non-enhanced Clayoquot Sound and Kyuquot Sound Chinook salmon streams in the indices all remain below 500 fish.



Escapement Methodology: The Upper Strait of Georgia (UGS) stock index consists of four rivers (Klinaklini, Kakweiken, Wakeman, Kingcome) in Johnstone Strait mainland inlets and the Nimpkish River on northeast Vancouver Island. The accuracy of escapement estimates in the mainland inlet systems is likely poor due to low visibility of glacial systems, remote access, and timing of surveys. Escapement estimates have primarily been based on aerial counts targeting other salmon species, which may not coincide with the main spawning period for Chinook salmon. Swim surveys and stream walks have been conducted in the Nimpkish River. A fish wheel program occurred on the Klinaklini River from 1997 to 2004. Based on the portion of the assessment program that continued in 2005, estimated abundance in 2005 was assumed to be the same as in 2004. Since 2006, the accuracy of the escapement estimate for the Klinaklini is considered to be very poor. Consequently, escapement for this stock was not included in the 2006 or 2007 index. No fish were observed in the Kakweiken River in 2006 or 2007.

Escapement Goal Basis: There is currently no CTC accepted escapement goal for this stock group.

Agency Comments: Assessment of stock status is highly uncertain and the escapement time series requires standardization to better represent this stock group in the PSC Chinook Model. Differences in ocean distributions, run timing, and life history indicate that future assessments should separate the stock group into CUs. Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for Salmon and Klinaklini Rivers, but estimates of total escapement are needed to make them effective.



Escapement Methodology: The LGS rivers are monitored for naturally spawning fall Chinook salmon escapement are the Cowichan and Nanaimo Rivers. Total Chinook salmon returns to the Cowichan and Nanaimo Rivers have been estimated since 1975. Prior to 1988, escapement estimates from the Cowichan River were derived from swim and aerial surveys. This approach was also used for the Nanaimo River prior to 1995. Since 1988 a counting fence has been used in the Cowichan River, and since 1995 carcass MR surveys have been used in the Nanaimo River. Since 2005, AUC estimates have been used in the Nanaimo River and a tagging study was used to determine survey life in 2006.

Escapement Goal Basis: An escapement goal of 6,500 for the Cowichan River was accepted by the CTC in 2005. There is currently no CTC accepted escapement goal for the Nanaimo, however habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for the Nanaimo River (Parken et al. 2006), and spawner abundances have been below S_{MSY} abundance recently.

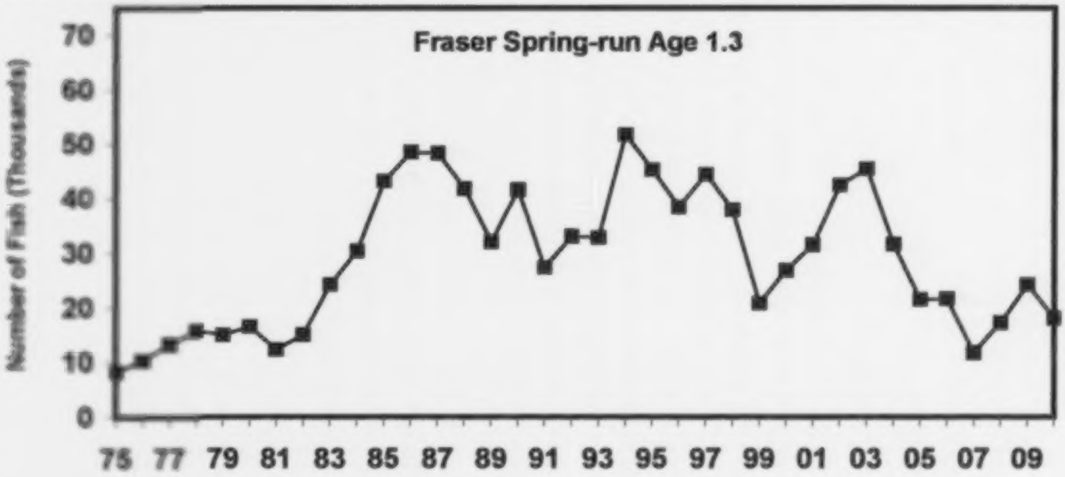
Agency Comments: The Cowichan Chinook salmon stock showed considerable increase in 1995 and 1996, followed by a rapid decline to conservation concern levels. Significant fishery management actions are used to reduce exploitation levels on the LGS Chinook salmon stock group.

2.4.2.4 Fraser River

The Fraser River watershed is the largest Canadian producer of Chinook salmon. Fraser Chinook salmon consist of many local populations as described in CTC (2002b).

Much of the knowledge about the status of Fraser Chinook salmon is based on spawner escapement data. Most data are from visual surveys, which are generally biased low, although many estimates are considered to be reasonably precise. Visual survey data are generated from aerial surveys and the escapement estimate is usually obtained by dividing the peak count by 0.65 (Farwell et al. 1999). The CDFO continues to evaluate the appropriateness of this expansion factor and AUC methodology through calibration studies and the SSPs (Section 3.1.4). Counting fences and MR projects exist for some systems, although most of the time series of escapement data from these projects are relatively short.

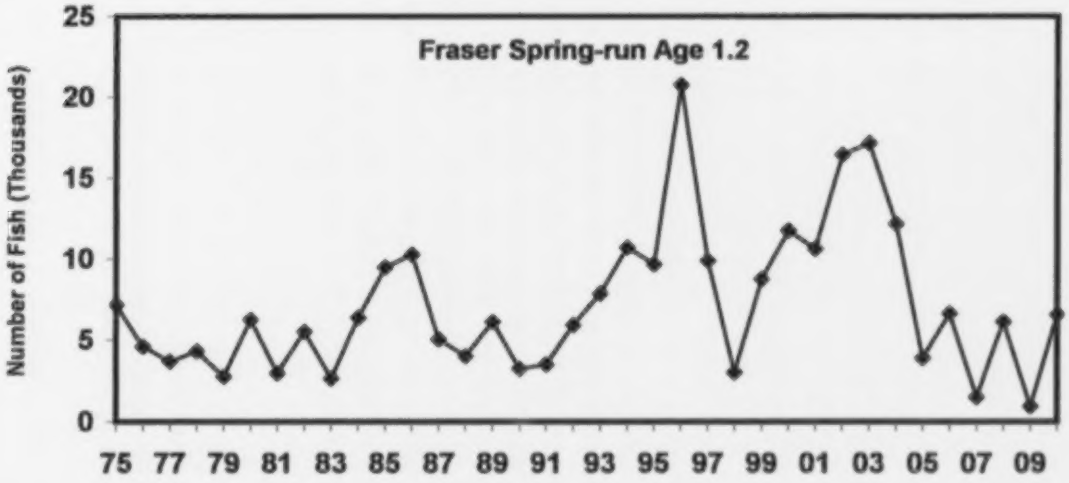
For populations other than the Harrison River, habitat-based models are being developed to estimate spawning capacity and spawner abundance producing maximum sustained yield. This habitat-based assessment will initially focus on predictive models based on Chinook salmon stock-recruitment relationships, although other habitat-based approaches will also be considered.



Escapement Methodology: The Fraser Spring-Run Age 1.3 aggregate includes the Upper Pitt River and Birkenhead River stocks in the Lower Fraser, and the spring-run stocks of the Mid and Upper Fraser, North Thompson, and South Thompson, but excluding those of the Lower Thompson tributaries (CTC 2002b). Escapements declined again in 2010, and also failed to exceed the parental brood escapement levels in 2005. Escapement to the aggregate was estimated at 18,061 in 2010; which was roughly 82% of the main brood year escapement in 2005.

Escapement Goal Basis: There is currently no CTC accepted escapement goal for this aggregate.

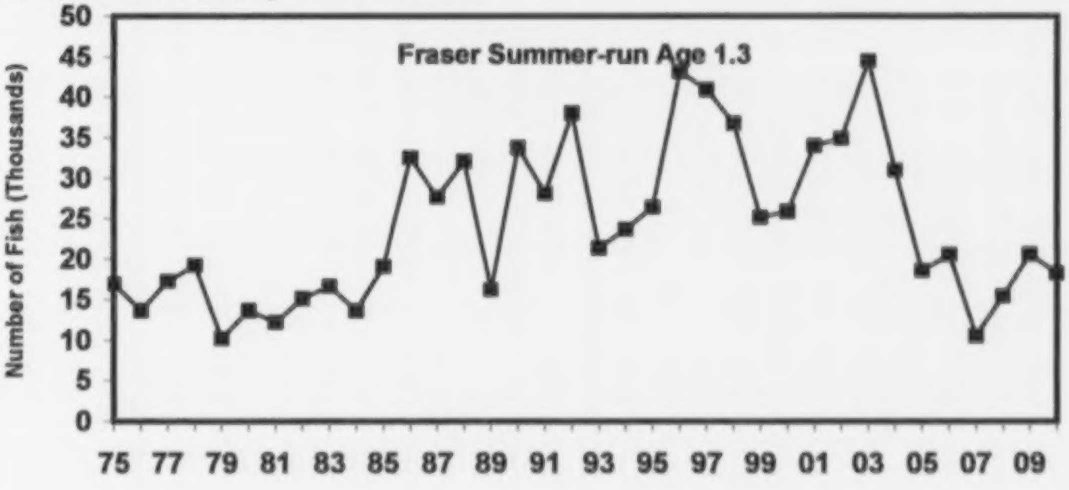
Agency Comments: Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for this stock group, but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements by developing factors that calibrate the visual survey indices to total escapements estimated by MR and electronic resistivity counter methods.



Escapement Methodology: The Fraser Spring-Run Age 1.2 aggregate includes six smaller body size populations that spawn in the Lower Thompson River tributaries, Louis Creek of the North Thompson and the spring-run fish of Bessette Creek in the South Thompson (CTC 2002b). Escapements to the aggregate improved in 2010, and approximately equaled those of the 2006 parental brood escapement. The estimated aggregate escapement was 6,576 of which escapements to the Nicola (4,711) were the principal contributor.

Escapement Goal Basis: There is currently no CTC accepted escapement goal for this aggregate.

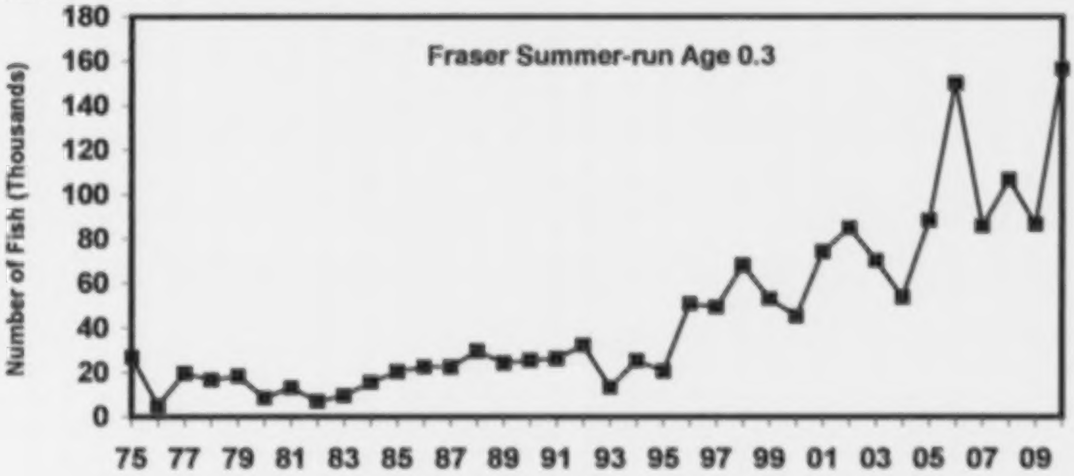
Agency Comments: Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for this stock group (Parken et al. 2006), but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements by developing factors that calibrate the visual survey indices to total escapements estimated by MR and electronic resistivity counter methods.



Escapement Methodology: The Fraser Summer-Run Age 1.3 aggregate includes 10 populations that spawn in large rivers, mostly below the outlets of large lakes. These include the Nechako River Chilko and Quesnel Rivers in the mid Fraser and the Clearwater River in the North Thompson watershed (CTC 2002b). Escapement surveys of the Stuart River and North Thompson River were discontinued in 2004 due to unreliable counting conditions. Escapements in 2010 declined over escapements in 2009; and were marginally below those of the parental brood year escapements in 2005. Aggregate escapement was estimated at 18,229, roughly 95% the 2005 parental brood escapement in 2005.

Escapement Goal Basis: There is currently no CTC accepted escapement goal for the aggregate.

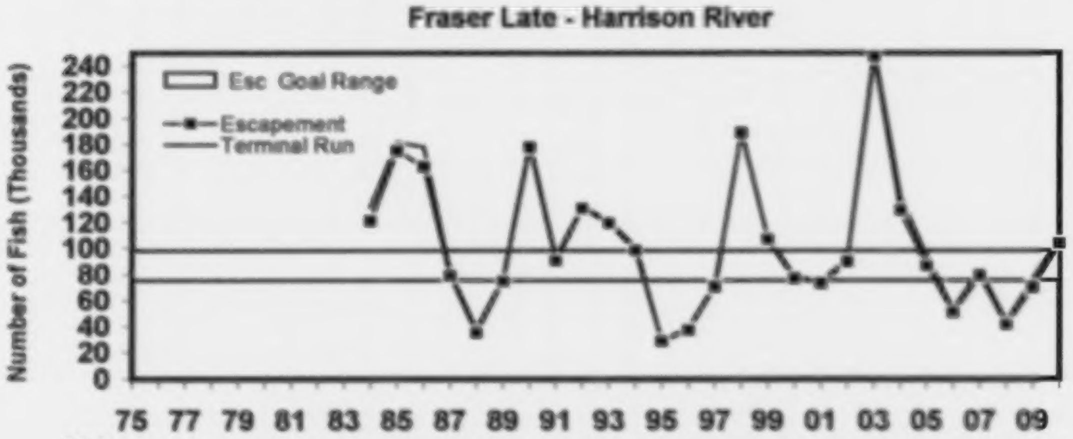
Agency Comments: Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for this stock group, but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements by developing factors that calibrate the visual survey indices to total escapements estimated by MR and area-under-the-curve methods.



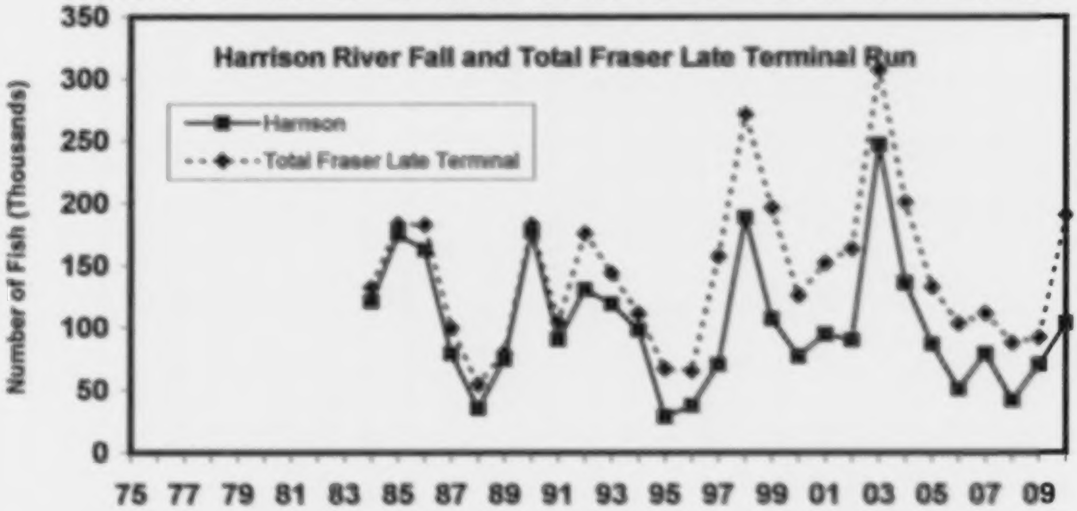
Escapement Methodology: The Fraser Summer-Run Age 0.3 aggregate includes six populations spawning in the South Thompson watershed upstream of Kamloops and one in the lower Fraser. These include the Middle Shuswap, Lower Shuswap, Lower Adams, Little River and the South Thompson River mainstem, in the BC interior, and Maria Slough in the lower Fraser (CTC 2002b). Escapements to the Summer Run Age 0.3 aggregate attained new record levels in 2010, and increased substantially over those observed in 2009. The 2010 aggregate escapement of 157,274 represents approximately 105% of the main parental brood year escapements in 2006.

Escapement Goal Basis: There is currently no CTC accepted escapement goal for the aggregate.

Agency Comments: Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for this stock group (Parken et al. 2006), but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements by developing factors that calibrate the visual survey indices to total escapements estimated by MR methods and novel methods via the SSP.



Fraser Late - Harrison River



Escapement Methodology: The Fraser late stock is dominated by fall returning Harrison-origin Chinook salmon that includes natural spawners in the Harrison River and Harrison-origin fish that were introduced to the Chilliwack River. Since 1984, MR studies have been conducted annually on the Harrison River to obtain reliable estimates of spawning escapements. Estimates of fall Chinook salmon escapement to the Chilliwack River are based on a procedure long established by the Chilliwack Hatchery staff for expanding the number of carcasses counted in standardized reaches of the river. Spawning escapements to the Harrison River in 2010 were estimated to be 103,515 adult Chinook salmon, and 10,546 jacks. Total fall Chinook salmon escapements to the Chilliwack River were estimated to be 74,947 adults and 9,975 jacks.

Escapement Goal Basis: Due to their natural abundance and importance in numerous British Columbia and Washington State fisheries, Harrison River Chinook salmon were designated as an escapement indicator stock (i.e., 'key stream' indicator) to aid in fulfilling commitments under the 1985 Pacific Salmon Treaty. In 1986, an interim escapement goal for Harrison River

Chinook salmon was established at 241,700 fish, based on doubling of the escapement estimate obtained from a MR program in 1984. In 2001, an escapement goal range was developed for Harrison Chinook salmon using a Ricker stock-recruit approach and is described in CTC (2002b). The escapement goal range that was proposed was 75,100-98,500 with the upper bound equal to the upper 75% confidence limit derived from a bootstrap procedure. This range was reviewed and accepted by the CTC. Estimated spawning escapements in the Harrison have exceeded this escapement goal range in nine years from 1984 to the present. They have fluctuated substantially with no apparent trend in the time series.

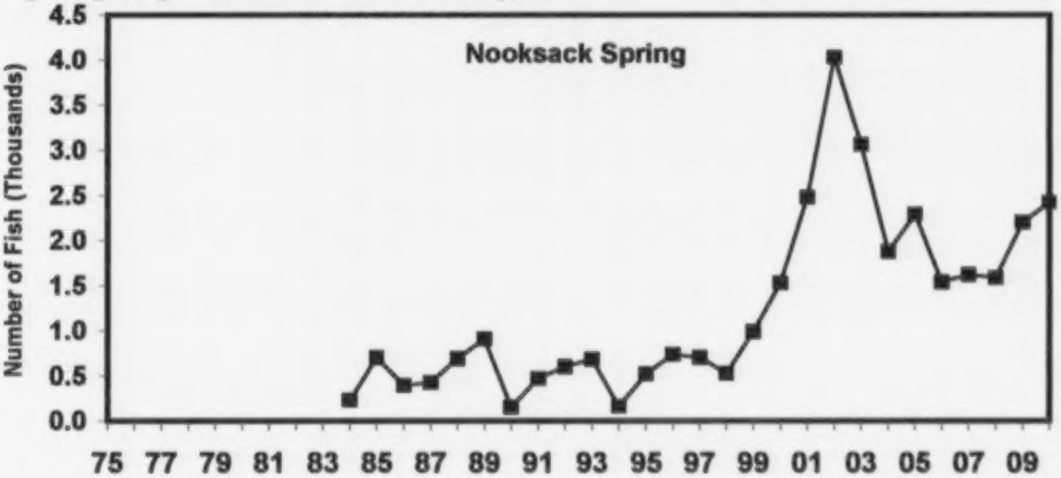
Agency Comments: Chinook salmon originating in the Harrison River are white-fleshed fish that return to spawn during the fall. They are unusual in that fry migrate into the lower Fraser River and estuary shortly after emergence. This stock spends 2-4 years in the coastal marine environment before returning to spawn. The Harrison River stock is one of the largest naturally spawning Chinook salmon populations in the world and makes important contributions to fisheries in the Strait of Georgia, southern BC, and Washington State.

2.4.3 Coastal Washington, Columbia River, and Coastal Oregon Stocks

2.4.3.1 Coastal Washington

The PSC escapement indicator stocks in Washington, Oregon, and Idaho are separated into five regional groups: Puget Sound, Washington Coastal, Columbia River, North Oregon Coastal, and Mid Oregon Coastal. The indicator stocks include a variety of run timings and ocean distributions. Some of these indictor stocks are components in the different stock groups listed in Attachment I-IV tables in the treaty.

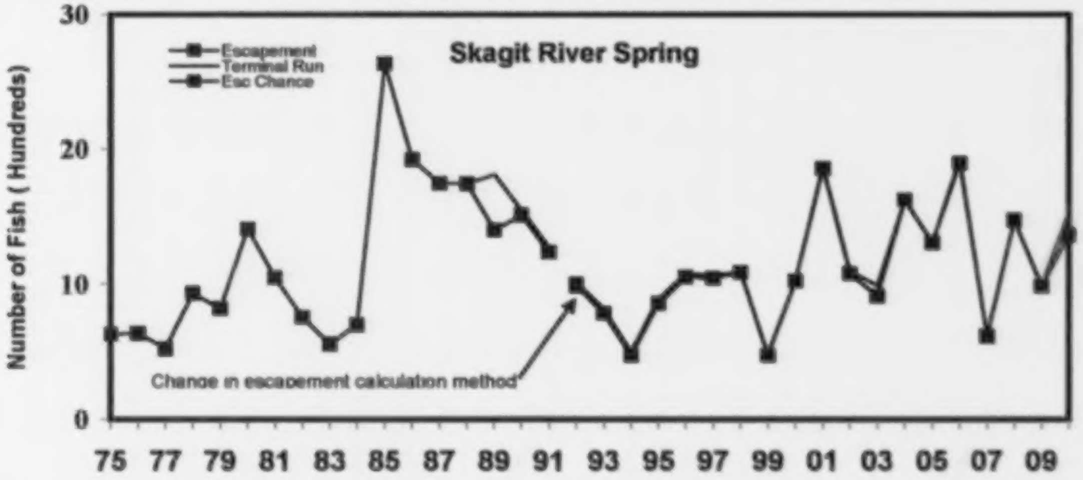
Biologically-based escapement goals have been reviewed and accepted by the CTC for three fall stocks (Queets, Quillayute, Hoh as part of the Washington Coastal Fall Natural Stock Group), two Spring/summer stocks (Queets, Hoh), four Columbia River stocks (Lewis, Upriver Brights and Deschutes as the Columbia River Fall Stock Group and the Columbia River Summer Stock Group), and three Oregon coastal stocks (Nehalem, Siletz and Siuslaw as the Far North Migrating Oregon Coastal Falls Stock Group).



Escapement Methodology: The Nooksack River drains into Puget Sound near Bellingham. The Nooksack spring Chinook salmon stock includes early-timed populations returning to the North and South forks of the Nooksack River. Estimates of the escapement in the South Fork have traditionally been based on the number of redds observed prior to the first of October expanded by 2.5 redds per spawner. Since 1999, this estimate has been further refined by separating hatchery-origin strays (North/Middle Fork and summer/fall Chinook salmon) based on CWTs, otolith marks or adipose fin clips, and also by assigning the natural origin spawners to the South Fork, North/Middle Fork and summer/fall hatchery stocks. The latter step is based on the expansion of the microsatellite DNA stock assignment of carcasses collected through the first week of October to apply to the total estimated natural origin spawners. The majority of the run is composed of hatchery-origin returns from the supplementation program. During 1999-2008, only 15% of the escapement in the North Fork and 50% of the escapement in the South Fork was composed of natural origin fish (CCMP 2010). In 2010, the natural escapement estimate was 2,044 for the North Fork and 377 for the South Fork.

Escapement Goal Basis: There is currently no CTC accepted escapement goal for this stock.

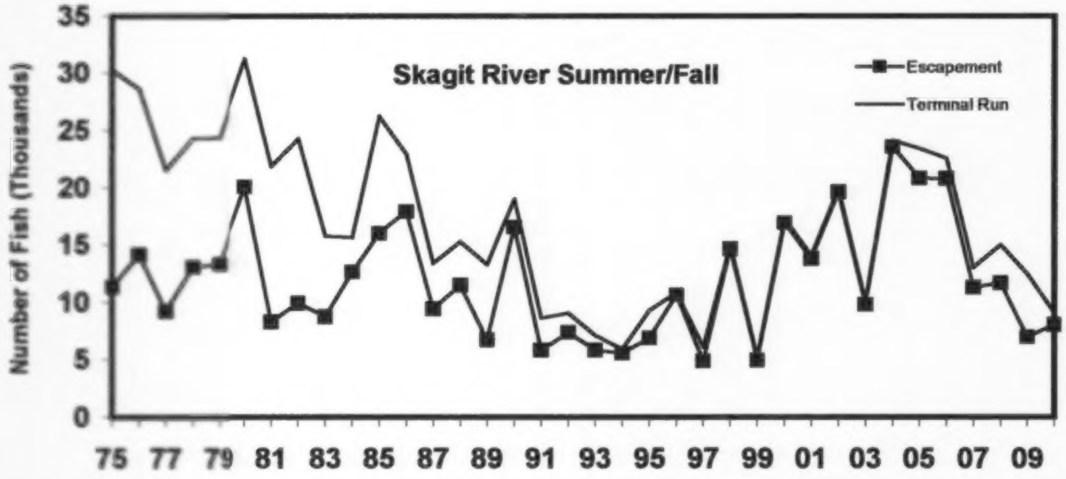
Agency Comments: The state-tribal escapement goal established for this Chinook salmon management unit is 4,000 spawners as an upper management threshold (UMT) and a low abundance threshold (LAT) of 2,000 natural origin fish (CCMP 2010). The UMT as established by the state-tribal managers is generally considered as the adult (age 3+) escapement level associated with maximum sustained catch. The LAT is the escapement level below which dramatic declines in long term productivity could occur. Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been for a ceiling exploitation rate rather than for a UMT or LAT escapement. The stock achieved the LAT in 2010.



Escapement Methodology: The Skagit River drains into northern Puget Sound near Mount Vernon, and is the largest drainage basin in Puget Sound. The Skagit spring Chinook salmon stock includes early-timed populations returning to the Upper Sauk, Cascade, and Suiattle Rivers. Due to changes in spawning index areas, beginning in 1992 for the Cascade stock and 1994 for the Sauk and Suiattle stocks, escapements are not directly comparable to previous numbers. In the Upper Sauk, redds are counted from RM 21.2-39.7 (Darrington to Forks), in the North Fork Sauk from the mouth to Falls, and in the South Fork Sauk (RM 0-2.5). This method replaced peak live and dead count approach in 1994. A redd life value of 30.2 days is used (avg of foot survey-based estimate = 22.9 days and AUC back calculated = 37.5 days). In the Cascade River, redds are counted in the mainstem upstream of RM 7.8 and in the lower north fork and south fork, and Found, Kindy, and Sonny Boy creeks Two helicopter flights occur over RM 7.8-18.6, and 5 foot surveys. In the Suiattle basin, redds are counted in mainstem Suiattle, and in Big, Tenas, Straight, Circle, Buck, Lime, Downey, Sulphur, and Milk creeks. Prior to 1994, peak live and dead fish counts in Big, Tenas, Buck, and Sulphur were used. The 2010 escapement estimate was 1,036 natural spawners.

Escapement Goal Basis: There is currently no CTC accepted escapement goal for this stock.

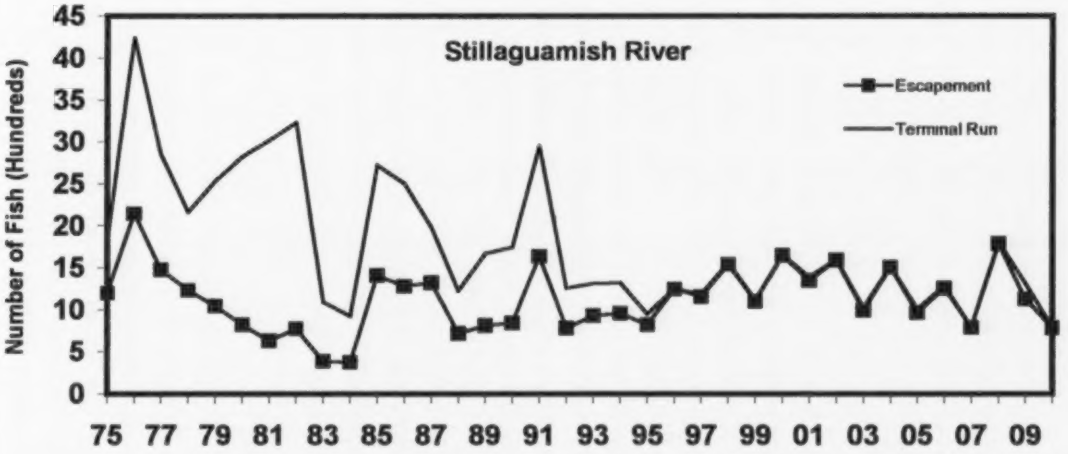
Agency Comments: The current UMT used by the state and tribal co-managers for the Skagit spring Chinook salmon management unit is 2,000 with a LAT of 576 (CCMP 2010). Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been for a total exploitation rate ceiling rather than for a UMT or LAT escapement.



Escapement Methodology: The Skagit River summer/fall Chinook salmon stock includes the Upper Skagit summer, Sauk summer, and Lower Skagit fall run populations. Escapement of Skagit summer/fall Chinook salmon was estimated using expansion of redd counts from helicopter surveys of mainstem areas and foot surveys of smaller tributaries. The counts are expanded by the area-under-the-curve method (Smith and Castle 1994). This method assumes a 21-day redd life and 2.5 adult spawners for each estimated redd. The estimate is then reduced by 5% to account for "false" redds counted during aerial surveys. The 2010 escapement estimate was 8,037. The terminal run estimate was 9,060. The methodology used to calculate the terminal run in the time series was modified in 2011 to include freshwater sport catch in the total return.

Escapement Goal Basis: There is currently no CTC accepted escapement goal for this stock group.

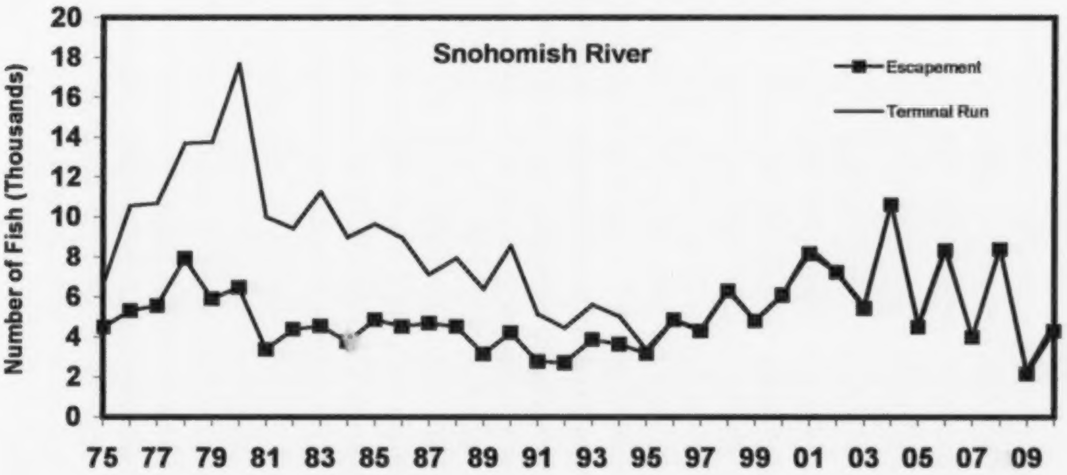
Agency Comments: The UMT used by the state-tribal co-managers for the Skagit summer/fall Chinook salmon management unit is 14,500 based on a recent assessment of freshwater productivity and accounting for variability and biases in management error (CCMP 2010). The LAT is 4,800 spawners. Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been for a total exploitation rate rather than for a UMT or LAT escapement. In years when the UMT is expected to be exceeded, terminal fisheries can be expanded subject to the overall ceiling exploitation rate.



Escapement Methodology: The Stillaguamish River drains into northern Puget Sound between Everett and Mount Vernon. The Stillaguamish Chinook salmon stock includes a run of summer-timed Chinook salmon in the North Fork of the Stillaguamish River and a much smaller number of fall fish in the South Fork of the Stillaguamish River and mainstem of the Stillaguamish River. Escapement estimates for Stillaguamish Chinook salmon were based on redd-count expansions, assuming a 21-day redd life. The North Fork of the Stillaguamish River is surveyed more extensively, with one to three aerial surveys and AUC redd estimates. The escapement estimates for the South Fork of the Stillaguamish River uses a peak redd count and assumes 2.5 fish per redd. Boulder and Squire Creeks on the North Fork of the Stillaguamish River and Jim Creek on the South Fork of the Stillaguamish River are also surveyed. Spawning escapement estimates of fall Chinook salmon may be biased low due to incomplete redd counts using visual sampling methods. Total natural spawning escapement in 2010 was estimated at783 fish. The methodology used to calculate the terminal run in the time series was modified in 2011 to include freshwater sport catch in the total return.

Escapement Goal Basis: There is currently no CTC accepted escapement goal for this stock group.

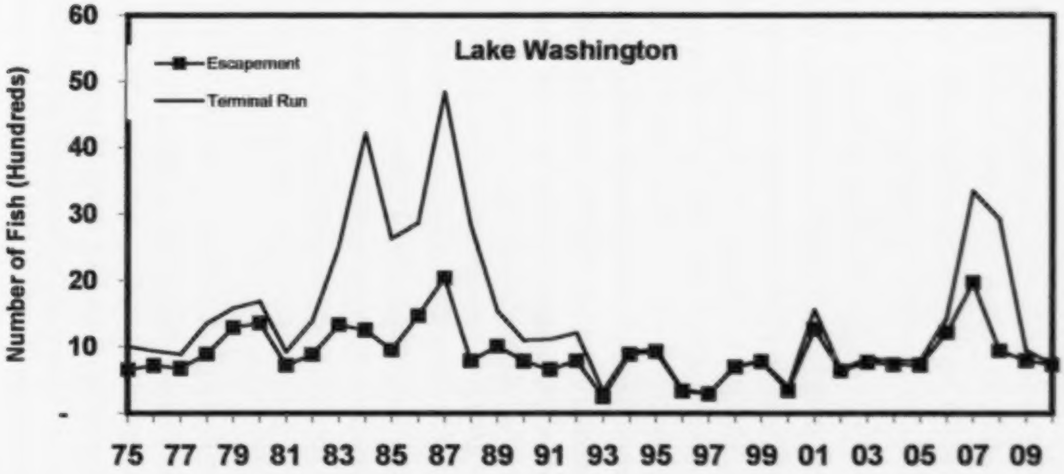
Agency Comments: State-tribal co-managers have established a UMT for this management unit of 900 natural origin spawners (600-North Fork of the Stillaguamish River and 300-South Fork of the Stillaguamish River and mainstem) with a LAT of 700 (CCMP 2010). The summer Chinook salmon supplementation program, which collects brood stock from the North Fork of the Stillaguamish River return, was initiated in 1986 as a Pacific Salmon Treaty indicator stock program, and its current objective is to release 200,000 tagged fingerling smolts per year. Most releases are into the North Fork of the Stillaguamish River, via acclimation sites; relatively small numbers of smolts have been released into the South Fork of the Stillaguamish River. Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been for a ceiling exploitation rate rather than for a UMT or LAT escapement.



Escapement Methodology: The Snohomish River is located in northern Puget Sound near Everett. The Snohomish Chinook salmon stock includes the Skykomish and Snoqualmie summer/fall run populations. Skykomish Chinook salmon spawn in the mainstem of the Skykomish River, and its tributaries including the Wallace and Sultan Rivers, in Bridal Veil Creek, the South Fork of the Skykomish River between RM 49.6 and RM 51.1 and above Sunset Falls (fish have been transported around the falls since 1958), and the North Fork of the Skykomish River up to Bear Creek Falls (RM 13.1). Snoqualmie Chinook salmon spawn in the Snoqualmie River and its tributaries, including the Tolt River, Raging River, and Tokul Creek. Escapement was estimated using expansion of redd counts conducted by a combination of helicopter, float, and foot surveys, and from fish counts at the Sunset Falls fishway. The 2010 escapement was estimated at 4,299 natural spawners. The methodology used to calculate the terminal run in the time series was modified in 2011 to include freshwater sport catch in the total return.

Escapement Goal Basis: There is currently no CTC accepted escapement goal for this stock.

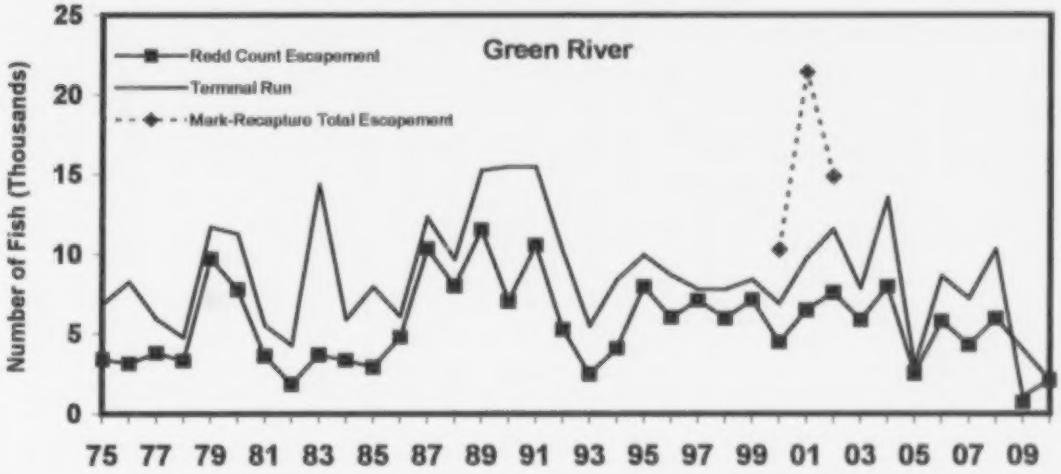
Agency Comments: The state-tribal co-managers have a UMT for this stock of 4,600 natural origin spawners (CCMP 2010). The LAT for Snohomish summer/fall Chinook salmon is 2,800 fish. Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been for a ceiling exploitation rate rather than for a UMT or LAT escapement.



Escapement Methodology: The Lake Washington Chinook salmon stock includes the fall run populations in the Cedar River and in the North Lake Washington tributaries of Bear, Cottage, and Issaquah creeks. Natural spawners in Issaquah Creek that spawn below the Issaquah Hatchery are not included in the graph. It should be noted that although there are no hatchery fish released into the Cedar River, an average of 23% of the spawners in 2003-08 were adipose clipped from mass-marked hatchery production, presumably from Issaquah Hatchery (CCMP 2010). Escapement in the Cedar River is estimated using expansion of total redd counts. In recent years, estimates of spawner abundance have also been made using redd counts performed over the entirety of the spawning area downstream of Landsburg Dam (CCMP 2010). These data were used to convert previous estimates of escapement within the index reach to estimates of spawner abundance (as would be derived through redd counts) for the entirety of the river (below the dam) using simple linear regression. Escapement to the North Lake Tributaries is estimated using live counts and AUC methods. The 2010 escapement for Lake Washington was 729 spawners, including 80 primarily hatchery origin fish in Bear and Cottage creeks. The methodology used to calculate the terminal run in the time series was modified in 2011 to include freshwater sport catch in the total return.

Escapement Goal Basis: There is currently no CTC accepted escapement goal for this stock.

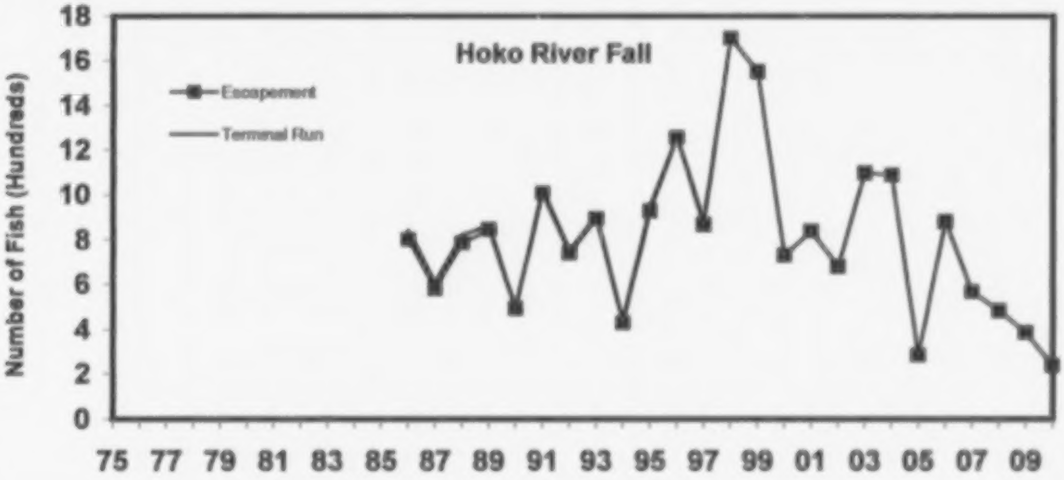
Agency Comments: A state-tribal interim UMT escapement goal of 1,200 Chinook salmon for an index reach in the Cedar River was established in 1993 based on average escapements in 1965-69. This goal for the index reach was converted to 1,680 Chinook salmon for the entirety of the river downstream of the dam. This number (1,680) reflects a redd-based escapement value consistent with the interim escapement goal derived using AUC methodology. Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been for a ceiling exploitation rate rather than for a UMT or LAT escapement in the Cedar River, except when the UMT is expected to be exceeded, some additional fishing in Lake Washington is considered.



Escapement Methodology: The Green River Fall Chinook salmon stock consists of a single population spawning in the mainstem Green River and two of its major tributaries, Newaukum and Soos creeks. Escapement is estimated from redd count expansion method that has varied over the time series by the extent of spawning survey coverage. The method used until about 1996 involved an index area redd count multiplied by 2.6 to estimate total redds then multiplied by 2.5 fish/redd to produce estimated escapement. The 2.6 index to total redd expansion factor was based on a U.S. Fish and Wildlife Service MR study in 1976 and 1977. Since 1996, the survey areas have broadened and the associated expansion factor of 2.6 has been reduced to the point that the redd counts in 2009 have complete spawning reach coverage. The method used in recent years provides natural escapement estimates for the mainstem Green River and Newaukum Creek. Newaukum Creek redds are counted during foot surveys. The mainstem Green River is surveyed by boat and by air. Some parts of the river (i.e. - the Gorge) are only surveyed by air. Boat surveys are generally done once a week, or twice a week in years with a large numbers of pink salmon. One aerial survey is made during the peak of spawning, more if budgets permit. Certain index reaches of the river are surveyed every week by boat to develop a cumulative redd count total for those reaches. These index reaches are distributed throughout the river. Visible redds are counted for the entire floatable part of the river by boat each week and for the entire river by helicopter during the peak. The ratio of visible redds seen by boat to those seen by air (boat surveys assumed to be best) is used to estimate how many redds would be seen by boat in the unfloated reaches. This provides an estimate of how many visible redds exist during the peak of spawning. To get from peak redds to cumulative total redds, the visible redds in the index reaches during the peak are compared to the season total for those index reaches. Different areas of the river have different ratios of peak visible redds to season totals. Expansion of non-index visible redds to season total redds uses the ratio from nearby index reaches of the same general character. The CTC considers these estimates from redd counts as index values rather than estimates of total escapement. Estimates of total escapement from MR studies in 2000-02 funded through the U.S. Letter of Agreement were more than three times higher than the escapement estimate from redd count expansion. There is a large hatchery program in this basin and these fish comprise a large portion of the return. Hatchery fish contribution to the natural escapement ranged from 53% to 65% for 2004-07. The escapement in 2010 from redd count expansion was 2,099 Chinook salmon of mixed hatchery and natural origin. The methodology used to calculate the terminal run in the time series was modified in 2011 to include freshwater sport catch in the total return.

Escapement Goal Basis: There is currently no CTC accepted escapement goal for this stock.

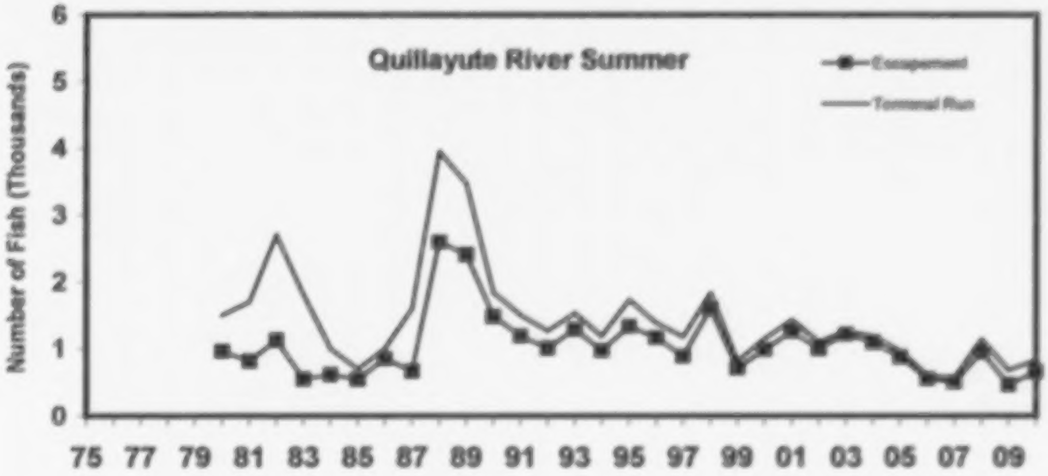
Agency Comments: The state-tribal UMT escapement goal of 5,800 naturally spawning adults is the average of the 1965-1976 escapements (Ames and Phinney 1977). The LAT is 1,800 fish. Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been on a ceiling exploitation rate in the southern U.S. pre-terminal fisheries and for the UMT in the terminal fisheries.



Escapement Methodology: Hoko River fall Chinook salmon spawn primarily in the mainstem of the Hoko, with limited spawning in larger tributaries. The Makah Tribe and WDFW conduct ground surveys using cumulative redd counts for the mainstem and tributaries found between RM 1.5-21.7, which represents the entire range of spawning habitat utilized by Chinook salmon. Redd counts are multiplied by 2.5 adults/redd. There are 10 mainstem reaches plus 13 tributary reaches, including Little Hoko, and Browne's, Herman, NF Herman, Ellis, Bear, and Cub (all upper mainstem tributaries). The tribe also surveys the mainstem Sekiu and Carpenter, SF Carpenter, Sunnybrook, and unnamed creeks 19.0215, 19.0216, and 19.0218. Brood stock collected from the spawning grounds for the supplementation program are included in the escapement estimate. In 2010, total natural spawning escapement was estimated to be 239.

Escapement Goal Basis: There is currently no CTC accepted escapement goal for this stock.

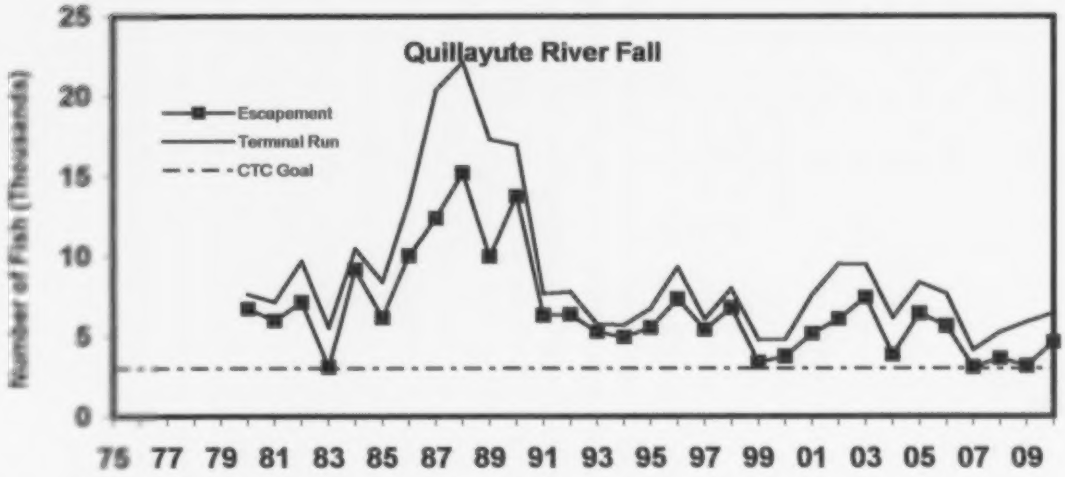
Agency Comments: The UMT escapement goal established by state and tribal co-managers is 850 naturally spawning adults. This goal was developed as a proxy for the spawning escapement for MSY. The escapement goal was calculated using a habitat based approach rather than a stock-recruitment analysis by estimating the amount of available spawning habitat, then expanded utilizing assumed optimal redds per mile and fish per redd values (Ames and Phinney 1977).



Escapement Methodology: Escapement estimates are based on redd counts in index areas and from supplemental surveys on the Bogachiel River, mainstem Calawah, and in the North Fork Calawah and Sitkum Rivers. This has been used consistently in the Quillayute River System since the 1970's. Surveys are conducted by foot, raft, drift boat and helicopter. Surveys in index areas are examined either weekly or bi-weekly as conditions allow. Supplemental surveys are done once a season during the peak spawning period. Redd counts from these supplemental surveys are then expanded by the index surveys to estimate redd construction within the supplemental survey areas for the entire season. Using an appropriate redds per mile assignment, the information from index and supplemental surveys is then applied to other streams and segments that have historically had fish presence, but were not surveyed. These areas comprise the Quillayute River system "stream mileage base" that is consistently calculated to estimate escapement numbers. The number of redds is multiplied by 2.5 to estimate fish escapement. The 2010 escapement estimate for summer Chinook salmon was 659 from a terminal run of 828.

Escapement Goal Basis: There is currently no CTC accepted escapement goal for this stock.

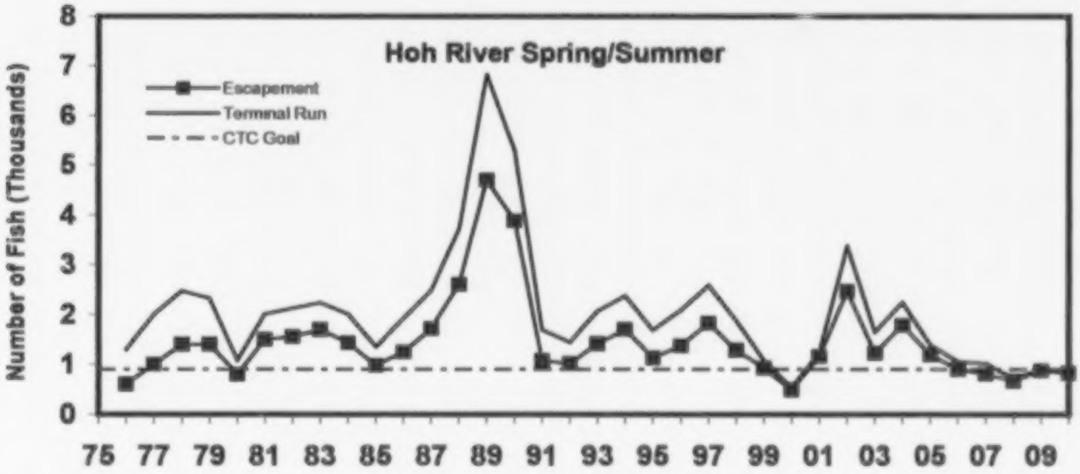
Agency Comments: The state-tribal management goal for this stock is 1,200 adults and jacks combined (PFMC 2003).



Escapement Methodology: Escapement estimates are based on redd counts in index areas and from supplemental surveys on the Bogachiel, Sol Duc, Dickey, Calawah Rivers and several other smaller tributaries in the basin. This has been used consistently in the Quillayute River System since the 1970's. Surveys are conducted by foot, raft, drift boat and helicopter. Surveys in index areas are examined either weekly or bi-weekly as conditions allow. Supplemental surveys are done once a season during the peak spawning period. Redd counts from these supplemental surveys are then expanded by the index surveys to estimate redd construction within the supplemental survey areas for the entire season. Using an appropriate redds per mile assignment, the information from index and supplemental surveys is then applied to other streams and segments that have historically had fish presence, but were not surveyed. These areas comprise the Quillayute River system "stream mileage base" that is consistently calculated to estimate escapement numbers. The number of redds is multiplied by 2.5 to estimate fish escapement. The 2010 escapement estimate was 4,635, with a total terminal run estimate of 6,431.

Escapement Goal Basis: The CTC approved in 2004 the escapement goal for Quillayute fall Chinook salmon of 3,000 natural spawners based on spawner-recruit analysis developed by Cooney (1984) and QDNR (1982).

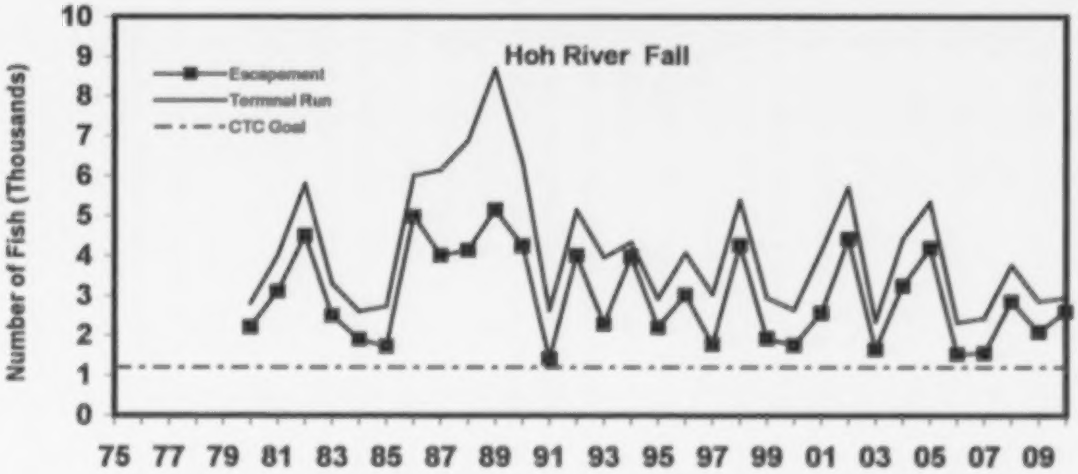
Agency Comments: Terminal fisheries are managed for a harvest rate of 40%, with an escapement floor of 3,000 fish (PFMC 2003). This objective is designed to actively probe at and above estimates of escapements that produce maximum sustained harvest (MSH), while minimizing potential detrimental effects of existing fisheries. Stock production analyses of spawning escapements from 1968-1982 were used to determine the initial escapement floor.



Escapement Methodology: Escapement is estimated from redd counts in index areas and from supplemental surveys in the mainstem and South Fork Hoh River and in Winfield, Owl, and Mount Tom creeks. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed each week where surveyors record total new and visible redds observed each week. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Extensive surveys are also conducted in non-intensively monitored stream areas utilized by spawning Chinook salmon. These extensive reaches encompass areas too large or remote to intensively monitor throughout the season. Extensive surveys are timed as close as possible to peak spawning activity. Extensive reach spawner abundance estimates are derived using index timing curves. For areas with suitable habitat but not regularly surveyed, redd densities (cumulative redds/river mile) from surveyed reaches with similar habitat-type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated assuming 2.5 fish/redd. The 2010 escapement estimate and total run size were 828 and 861 respectively.

Escapement Goal Basis: Escapement floor policy of 900 for the Hoh spring/summer Chinook salmon was developed by Cooney (1984) and QDNR (1982), based on spawner-recruit analyses, and was accepted by the CTC in 2004.

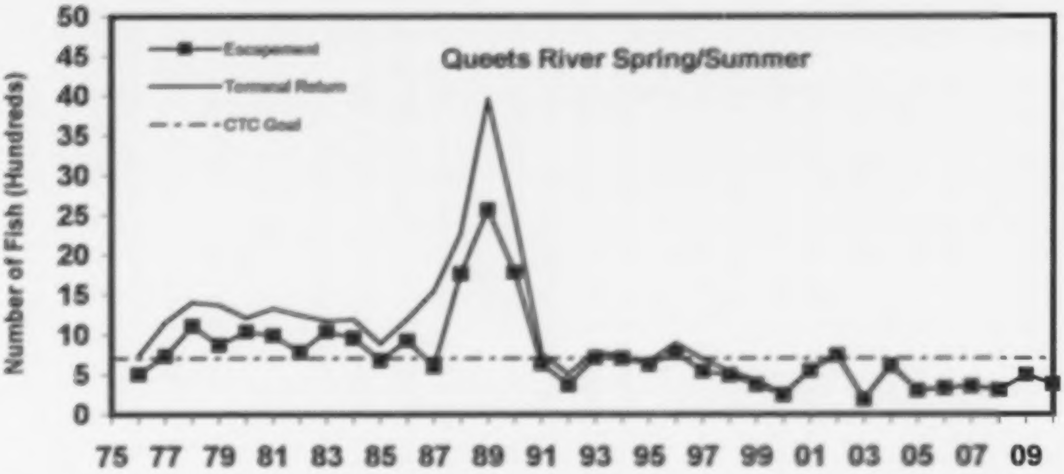
Agency Comments: Similar to many of the other Washington coastal stocks, Hoh River spring/summer escapements have been relatively stable except for much larger returns in 1988, 1989, and 1990. The terminal return for this stock declined from 1997 to 2000, had rebounded in 2001 before declining again since 2005. Terminal fisheries are managed to harvest 31% of the river run, with an escapement floor of 900 fish (PFMC 2003). This objective is designed to allow a wide range of spawner escapements from which to eventually develop an MSY objective or proxy while protecting the long-term productivity of the stock. Stock production analysis of spawning escapement for brood years 1969-1976 was utilized to determine the initial escapement floor.



Escapement Methodology: Escapement is estimated from redd counts in index areas and supplemental surveys in the mainstem and South Fork Hoh River and in tributaries with spawning habitat. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed each week where surveyors record total new and visible redds observed each week. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Extensive surveys are also conducted in non-intensively monitored stream areas utilized by spawning Chinook salmon. These extensive reaches encompass areas too large or remote to intensively monitor throughout the season. Extensive surveys are timed as close as possible to peak spawning activity. Extensive reach spawner abundance estimates are derived using index timing curves. For areas with suitable habitat but not regularly surveyed, redd densities (cumulative redds/river mile) from surveyed reaches with similar habitat-type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated assuming 2.5 fish/redd. The natural escapement estimates for Hoh River fall Chinook salmon include fish taken for brood stock. The 2010 escapement estimate was 2,599 fish. Terminal run estimate was 2,941.

Escapement Goal Basis: The escapement floor of 1,200 for the Hoh fall Chinook was developed by Cooney (1984) and QDNR (1982), based on spawner-recruit analyses, and was accepted by the CTC in 2004 as the escapement goal.

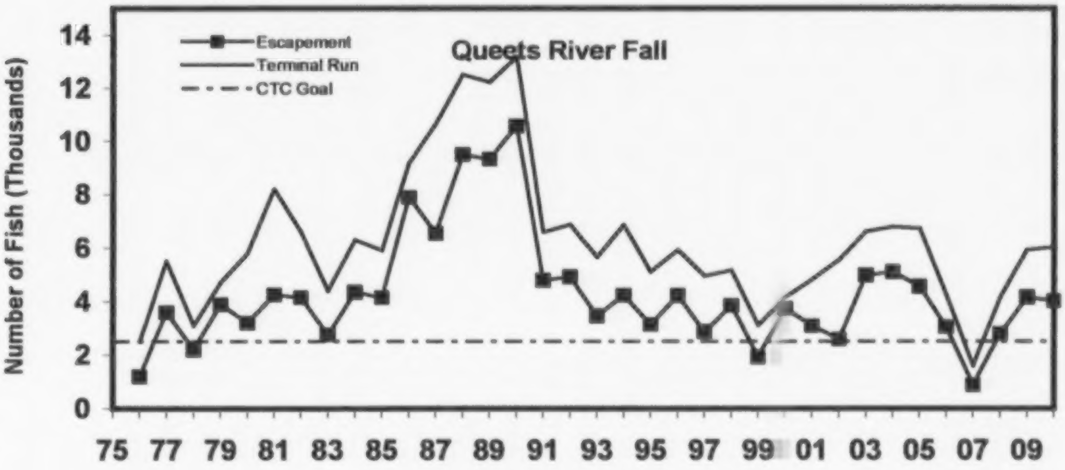
Agency Comments: The state-tribal management plan for this stock includes a harvest rate of 40% of the terminal run, with an escapement floor of 1,200 spawners (PFMC 2003). This objective is designed to actively probe at and above estimates of the escapements that produce MSH, while minimizing potential detrimental effects of existing fisheries. Stock production analyses of spawning escapements from 1968-1982 were utilized to determine the initial escapement floor.



Escapement Methodology: Escapement is estimated from redd counts during August 15 through October 15 for spring/summer Chinook salmon. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed each week where surveyors record total new and visible redds observed each week. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Extensive surveys are also conducted in non-intensively monitored stream areas utilized by spawning Chinook salmon. These extensive reaches encompass areas too large or remote to intensively monitor throughout the season. Extensive surveys are timed as close as possible to peak spawning activity. Extensive reach spawner abundance estimates are derived using index timing curves. For areas with suitable habitat but not regularly surveyed, redd densities (cumulative redds/river mile) from surveyed reaches with similar habitat-type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated assuming 2.5 fish/redd. The 2010 estimate of escapement and terminal return was 382.

Escapement Goal Basis: Escapement floor policy of 700 for Queets spring/summer Chinook salmon was developed by Cooney (1984) and QDNR (1982), based on spawner-recruit analyses, and was accepted by the CTC in 2004 as the escapement goal. Stock production analysis of spawning escapements for brood years 1969-1976 were used to determine the initial escapement floor.

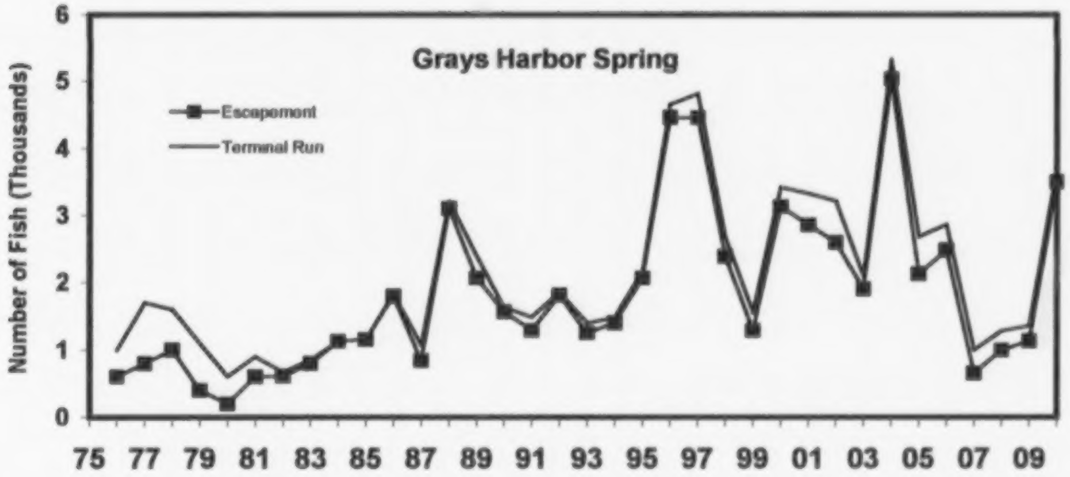
Agency Comments: Terminal fisheries are managed by the state and tribes to harvest 30% of the river run size, with an escapement floor of 700 fish (PFMC 2003). This objective is designed to actively probe at and above the estimates of escapement that produce MSH. Since 1990, terminal fisheries have had minimal impact on this stock as returns to the river have rarely exceeded the escapement floor. Since 2000, sport anglers have been required to release all Chinook salmon during the summer, and tribal fisheries have been limited to one tribal netting day for ceremonial and subsistence purposes.



Escapement Methodology: Escapement is estimated from redd counts during October 15 through December 1 for fall Chinook salmon. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed each week where surveyors record total new and visible redds observed each week. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Extensive surveys are also conducted in non-intensively monitored stream areas utilized by spawning Chinook salmon. These extensive reaches encompass areas too large or remote to intensively monitor throughout the season. Extensive surveys are timed as close as possible to peak spawning activity. Extensive reach spawner abundance estimates are derived using index timing curves. For areas with suitable habitat but not regularly surveyed, redd densities (cumulative redds/river mile) from surveyed reaches with similar habitat-type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated assuming 2.5 fish/redd. For Queets River fall Chinook salmon, the 2010 escapement was 4,022 and the terminal run was 6,032.

Escapement Goal Basis: the escapement floor policy of 2,500 for the Queets fall Chinook was developed by Cooney (1984) and QDNR (1982), and was based on spawner-recruit analyses, and was accepted by the CTC in 2004 as the escapement goal.

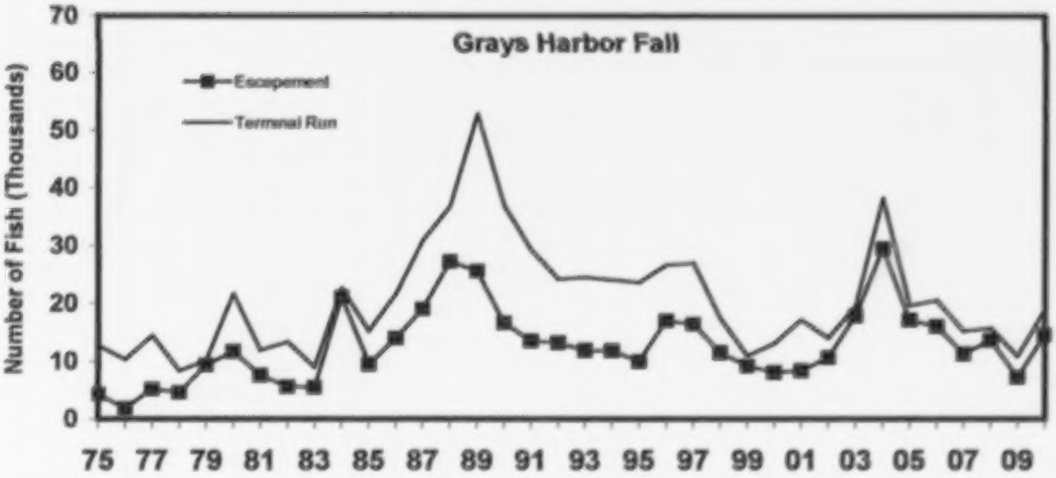
Agency Comments: Terminal fisheries are managed by the state and tribes to harvest 40% of the river return, with an escapement floor of 2,500 spawners (PFMC 2003). This objective is designed to actively probe at and above estimates of the escapements that produce MSH. Stock production analyses of spawning escapements from 1967-1982 were used to determine the initial escapement floor.



Escapement Methodology: Escapement is estimated by redd counts during August 15 through October 15 for spring/summer Chinook salmon. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed each week where surveyors record total new and visible redds observed each week. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Extensive surveys are also conducted in non-intensively monitored stream areas utilized by spawning Chinook salmon. These extensive reaches encompass areas too large or remote to intensively monitor throughout the season. Extensive surveys are timed as close as possible to peak spawning activity. Extensive reach spawner abundance estimates are derived using index timing curves. For areas with suitable habitat but not regularly surveyed, redd densities (cumulative redds/river mile) from surveyed reaches with similar habitat-type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated assuming 2.5 fish/redd. The 2010 escapement was 3,497 Chinook salmon and the terminal run 3,704.

Escapement Goal Basis: There is currently no CTC accepted escapement goal for this stock group.

Agency Comments: The natural spawning escapement goal established by the state-tribal co-managers for Grays Harbor spring Chinook salmon is 1,400 adult fish (PFMC 2003). This single targeted goal was developed as a MSY proxy. This objective was derived from actual spawning data from the mid- to late 1970s, expanded to include additional habitat not covered by spawner surveys.

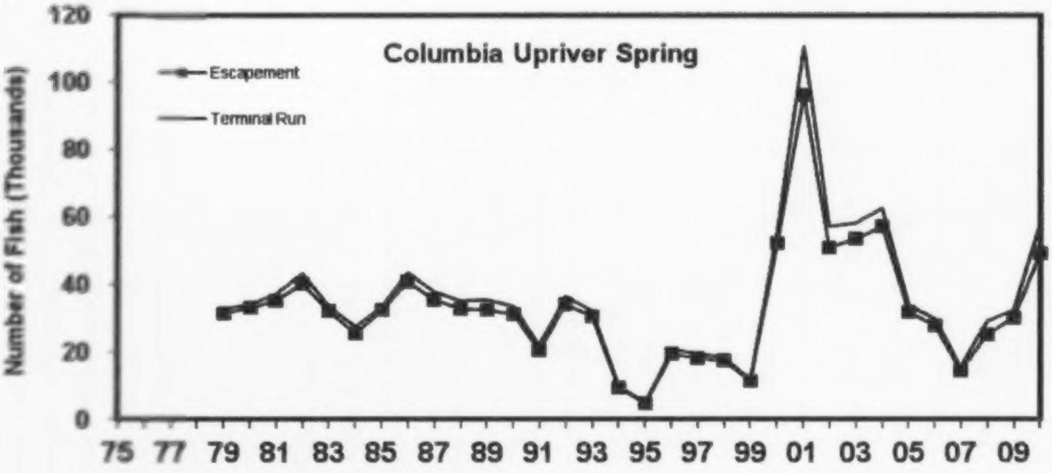


Escapement Methodology: Escapement is estimated from redd counts during October 15 through December 1 for fall Chinook salmon. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed each week where surveyors record total new and visible redds observed each week. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Extensive surveys are also conducted in non-intensively monitored stream areas utilized by spawning Chinook salmon. These extensive reaches encompass areas too large or remote to intensively monitor throughout the season. Extensive surveys are timed as close as possible to peak spawning activity. Extensive reach spawner abundance estimates are derived using index timing curves. For areas with suitable habitat but not regularly surveyed, redd densities (cumulative redds/river mile) from surveyed reaches with similar habitat-type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated assuming 2.5 fish/redd. The 2010 escapement was 14,531spawners from a terminal run of 18,802 Chinook salmon.

Escapement Goal Basis: There is currently no CTC accepted escapement goal for this stock group.

Agency Comments: The state-tribal escapement goal for Grays Harbor fall Chinook salmon is 14,600 spawners to the combined Chehalis and Humptulips Rivers (PFMC 2003). This single targeted goal was developed as an MSY proxy. The objective represents assumed optimal spawner density based on estimated available habitat.

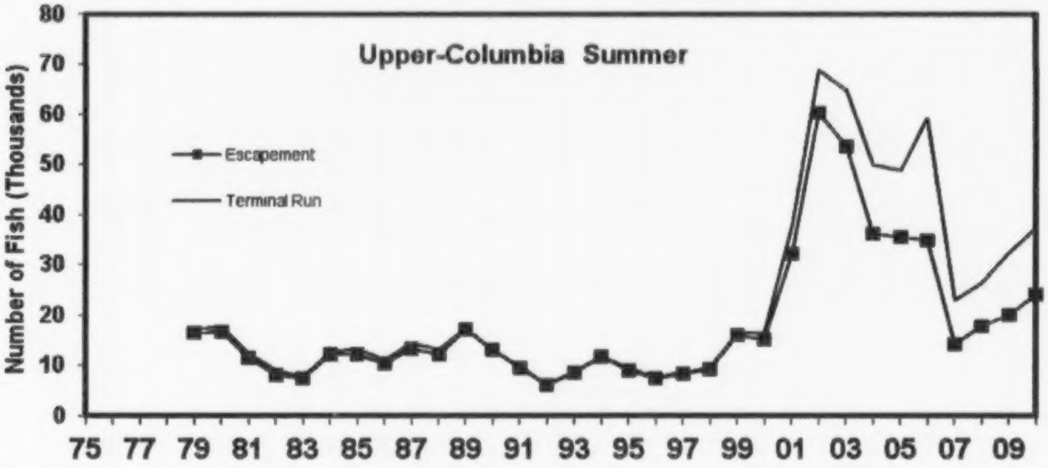
2.4.3.2 Columbia River



Escapement Methodology: The Columbia Upriver Spring Chinook salmon stock is an aggregate of Upper Columbia spring Chinook salmon and Snake River spring/summer Chinook salmon. Historically, the Bonneville run through June 1 was used in assessments, but the date was changed to June 15 to include the Snake River spring/summer Chinook salmon, which were listed under the ESA in 1992 and pass Bonneville Dam in that time period, so the ESA listed stock could be managed under a more restrictive harvest rate. The escapement in the graph was calculated as the dam count at Bonneville Dam from January 1 through June 15 minus all harvests and incidental mortalities above Bonneville Dam, multiplied by the estimated proportion that spawn naturally, according to the Columbia River Technical Advisory Committee (CTAC) run reconstructions prepared for the biological assessment under the ESA. The interim management goal for the Columbia River Fish Management Plan (CRFMP) for Columbia River Springs was 115,000 hatchery and wild adult Chinook salmon counted at Bonneville Dam and 25,000 naturally-produced plus 10,000 hatchery-produced adults counted at Lower Granite Dam (CRFMP 1988). Under the 2008-2017 *U.S. v OR* Management Agreement, fishery impacts on natural origin fish are managed using a harvest rate schedule based on expected river mouth abundance.

Escapement Goal Basis: This stock is not managed for an escapement goal. It is managed for an abundance-based harvest rate schedule ranging from 5.5% to 14.3%.

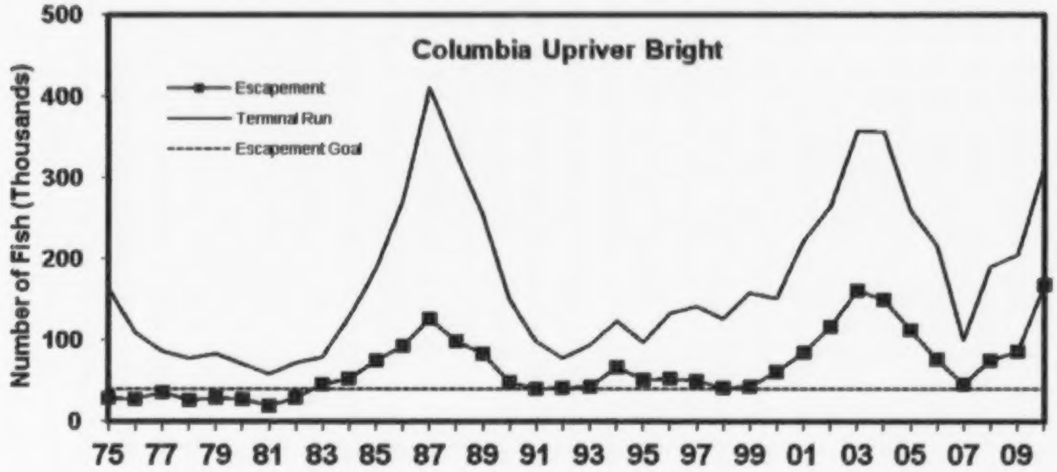
Agency Comments: The 2008-2017 *U.S. v OR* Management Agreement (MA) provides for a minimum annual mainstem treaty Indian Ceremonial and Subsistence entitlement to the Columbia River treaty tribes of 10,000 spring and summer Chinook salmon. Fisheries are managed according to the catch rate schedule in Table A1 of the 2008-2017 MA, with allowable impact rates dependant on total upriver spring Chinook salmon run size. Beginning in 2010, modifications to Table A1 were implemented requiring non-Indian fisheries to meet catch balance provisions in the MA for upriver spring Chinook salmon. Under these provisions, non-Indian fisheries are managed to remain within ESA impacts, *and* to not exceed the TAC available for treaty fisheries. Non-Indian fisheries in 2010 were restricted to no more than 70% of the available catch specified for treaty fisheries at the preseason forecasted run size for use prior to a run size update.



Escapement Methodology: The escapements graphed above are the Bonneville summer Chinook salmon count beginning June 15 minus Zone 6 and upper Columbia catches and incidental mortalities, multiplied by the proportion of the run returning to the Upper Columbia (Priest Rapids dam count as a proportion of the sum of the Priest Rapids and the largest Snake River dam counts), multiplied by the proportion of non-harvested summer Chinook salmon crossing Bonneville that spawned naturally (as calculated by the CTAC run reconstruction). Terminal run is calculated as the Bonneville run plus the catches and incidental mortalities below Bonneville, multiplied by the same two proportions (proportion Columbia and proportion naturally spawning). Incidental mortalities were subtracted, as were additional catches by the Colville and Wanapum tribes. In 2009, CTAC began using counts at Rock Island to calculate summer Chinook salmon conversion rates, rather than Priest Rapids dam counts, so the entire time series of conversion rates changed.

Escapement Goal Basis: The CTC (1999) developed an interim biologically-based MSY escapement goal of 17,857 naturally spawning upper-Columbia summer Chinook salmon past Bonneville Dam based on PSC Chinook salmon model data. The model data used to develop the escapement goal are different than the actual escapement estimates graphed above, and thus may not be directly comparable. A revised goal using actual escapement data was developed and reviewed by the CTC in 2008 and resulted in a similar goal, but modifications to the analysis were requested and no action was taken.

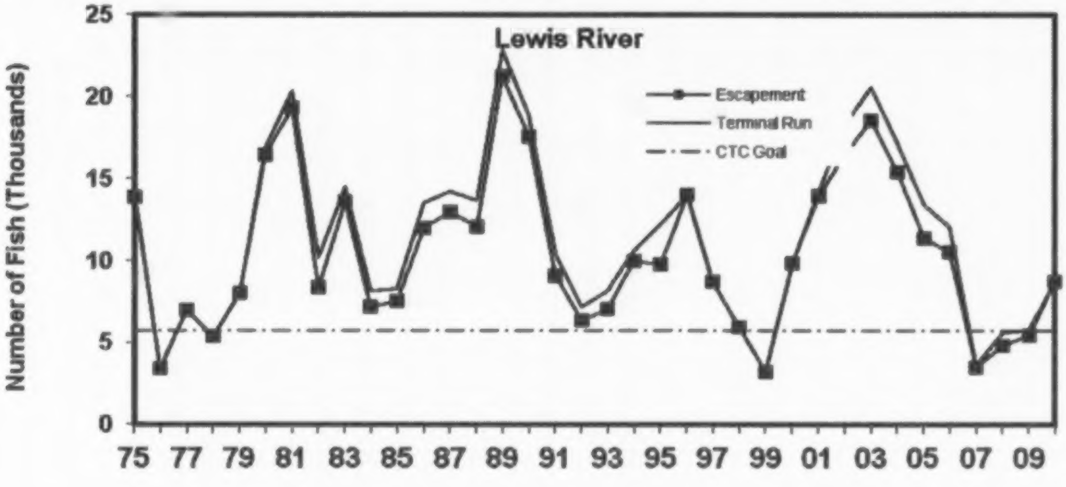
Agency Comments: Columbia River summer Chinook salmon fisheries occur from June 16 through July 31, according to a catch rate schedule based on expected river mouth abundance. The schedule is provided in Table A2 of the 2008-2017 *U.S. v OR* MA. In addition, upper Columbia River summer Chinook salmon are managed for a goal of 29,000 hatchery and natural origin adults, as measured at the Columbia River mouth. This management goal is based on an interim combined spawning escapement goal of 20,000 hatchery and natural adults, including the following three components: 13,500 Wenatchee/Entiat/Chelan natural fish, 3,500 Methow/Okanogan natural fish and 3,000 hatchery fish.



Escapement Methodology: Escapement estimates are calculated as the McNary Dam count minus Hanford Reach adult sport catch, minus brood stock taken by Priest Rapids, Ringold and Snake River hatcheries.

Escapement Goal Basis: The CTC agreed escapement goal for the Columbia River Upriver Bright Chinook salmon is 40,000 naturally spawning fish past McNary dam based on stock-recruitment analyses.

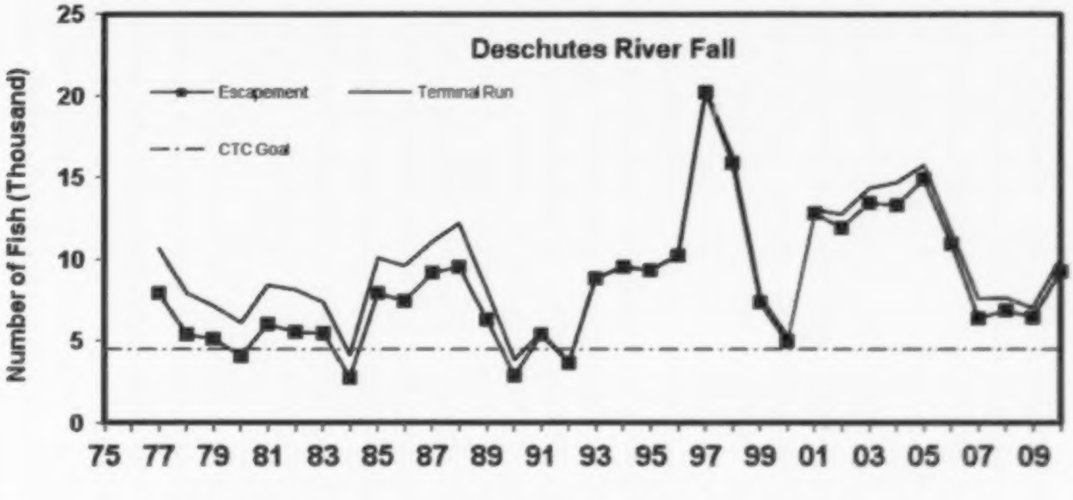
Agency Comments: Under the 2008-2017 *U.S. v OR* Management Agreement, the minimum combined Columbia River and Snake River upriver bright management goal at McNary Dam is 60,000 adult fall Chinook salmon, which includes both hatchery and natural production for all areas above McNary Dam. The Parties also agreed to 43,500 as the minimum Upriver Bright adult escapement to meet the combined Hanford Reach, lower Yakima River, and mainstem Columbia River above Priest Rapids Dam natural spawning goal, as well as the current Priest Rapids Hatchery production (this historically included a minimal run to the Snake River).



Escapement Methodology: Most natural bright fall Chinook salmon production below Bonneville Dam occurs in the North Fork Lewis River. The Lewis River Wild stock is the main component of the Lower River Wild management unit for fall Chinook salmon, which also includes small amounts of wild production from the Cowlitz and Sandy River basins. In this report, the escapements and goal are for the Lewis River component. Annual escapement estimates are obtained by expanding peak counts from weekly counts of live and dead fish in the 6.4 km area below Merwin Dam (rkm 31.4) by a factor of 5.29 (total spawners/peak count) and this factor was derived from a carcass tagging and recapture study performed in 1976 (McIsaac 1990). From 1999-2001, LOA funds were used to conduct a study to estimate and verify the expansion factor. A CWT program for wild fish has been in place since the 1977 brood. Methods of CWT recovery, escapement counting, and expansion of the index area fish counts have been consistent since 1964. All naturally spawning adult fish, both from hatchery and natural production, are included in the escapement. The terminal run is escapement plus the adult sport catch in the Lewis River.

Escapement Goal Basis: The escapement goal of 5,700 fall Chinook salmon in the Lewis River was developed by McIsaac (1990), based on spawner-recruit analysis of the 1964-1982 broods and CWT recoveries from the 1977-1979 broods. This analysis was updated in CTC (1999) based on analysis of brood years 1964-1991 and the goal of 5,700 was reaffirmed and accepted as a biologically based goal.

Agency Comments: Except for 1999, the Lewis River escapements had been above their escapement goal since 1979 until 2007 through 2009, when it was somewhat below goal. In 2010, it was again above goal.



Escapement Methodology: Escapement data are based on a MR estimate for the area above Sherars Falls, expanded for redd counts below Sherars Falls. From 2000 through 2007, Confederated Tribes of the Warm Springs (CTWS) performed an entire river MR experiment to validate the Deschutes River fall Chinook salmon escapement estimates. Results of these MR studies confirm the validity of the historical estimation methodology. For historic years where redd counts were not censured for the entire river, the entire time series of data was updated based on a comprehensive analysis done by Warm Springs, ODFW and Columbia River Intertribal Fish Commission (CRITFC) staff (Sharma et. al. 2010). An escapement goal was derived from the updated time series and approved by the CTC. The metric reported above is the ODFW MR estimate based on expanding the Sherars Falls MR estimate for redds below Sherars Falls.

Escapement Goal Basis: The CTC agreed escapement goal for Deschutes River fall Chinook salmon is 4,532 fish (Sharma et. al. 2010).

Agency Comments: Deschutes River fall Chinook have been maintained above the escapement goal since 1992.

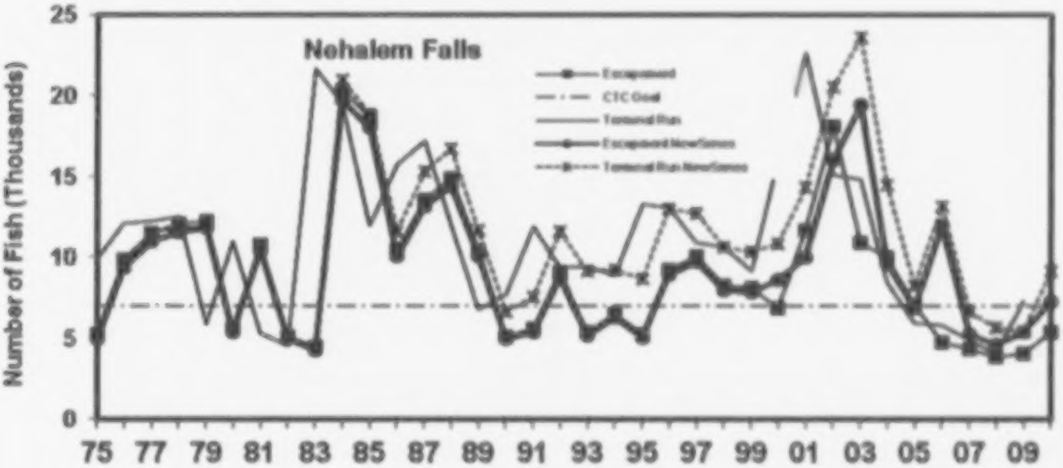
2.4.3.3 Coastal Oregon

2.4.3.3.1 Oregon Coastal North Migrating

Currently, only NOC fall Chinook salmon are accounted for in PSC management, while work is underway to include MOC production into the auspices of the PSC regime. The NOC production is bounded by the Necanicum at the northern range through the Siuslaw basin at the southern extent of the NOC. After a period of precipitous declines in escapement during 2007, 2008 and 2009, the NOC stock aggregate has indicated signs of rebuilding to historical averages during the 2010 return year. There are three escapement indicator stocks representing the production of NOC Chinook salmon; the Nehalem, Siletz and Siuslaw stocks. The geographic range of production encompassed by the NOC includes 4 additional major basins, the Tillamook, Nestucca, Yaquina and Alsea. The Tillamook drainage system includes 5 sub-basins including the Kilchis, Miami, Trask, Wilson and Tillamook Rivers. Total estimated spawning escapement in this aggregate has ranged from approximately 39,000 in 2008 to 190,000 in 1988. The ten year (2001-2010) average for the NOC aggregate escapement is about 94,000. Estimated escapement in 2010 was 65,000. Abundance forecasts are expressed in terms of spawning escapement. Forecasted escapement for 2011 is 78k. Forecasts for this aggregate are based on sibling-regression relationships developed for each discrete population, both indicator and non-indicator stocks. The aggregated forecast for the NOC is the sum of the forecasts for the individual basins within the geographic range. These methods were developed in 2008 and are continually refined with each year's additional information. Prior to 2008, the aggregate forecast (and each of the indicator stock's forecasts) was based on a running three year average.

All three NOC escapement indicators did not achieve goal in either 2007 or 2008, and the Nehalem did not attain goal in 2009 or 2010 either, but all three escapement indicator stocks are forecasted to reach their goal in 2011. Recent-year escapements in the southern range of the NOC (Siuslaw, Alsea) have shown encouraging rates of rebound, while their northern counterparts (Nehalem, Tillamook, Nestucca) have displayed a more protracted rebuilding pattern. Escapements in the middle of the NOC area have been observed to be steadily rebuilding between the northern and southern extremes of the aggregate.

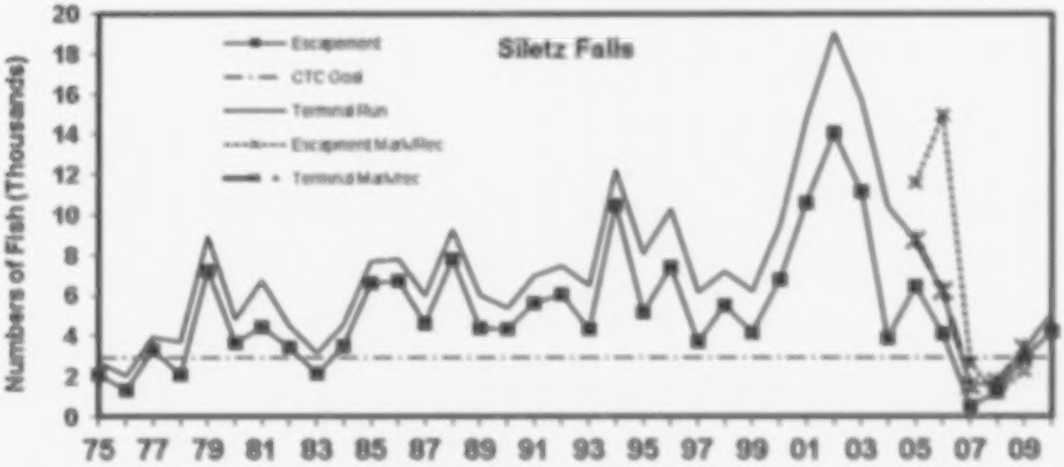
Terminal fisheries management action, in concert with AC reductions in AABM fisheries, is contributing to the rebuilding of the NOC escapement. Terminal fisheries restrictions, which included closure during the 2009 return year in the Nehalem, have been adopted and maintained through the 2010 return year. Many of these restrictions were dropped for the 2011 return year in the southern extent of the geographic aggregate, but most have been retained or extended from those basins north of the Nestucca.



Escapement Methodology: Both directed MR study and historically conducted surveys have been utilized to measure escapement during the past return year. Normative estimates are generated from conducting surveys of peak abundance in historically walked predefined areas of known Chinook salmon spawning habitat within the basin. These observations are then multiplied by an estimate of the total available habitat, an accounting for observer biases, an estimate of the total run encountered during the peak, and an estimate of the bias seen between these predefined surveys and those that are randomly selected.

Escapement Goal Basis: The current point goal of 6,989 spawners was derived by Zhou & Williams in 1999 and was based on assessments of escapement made through normative survey methodology.

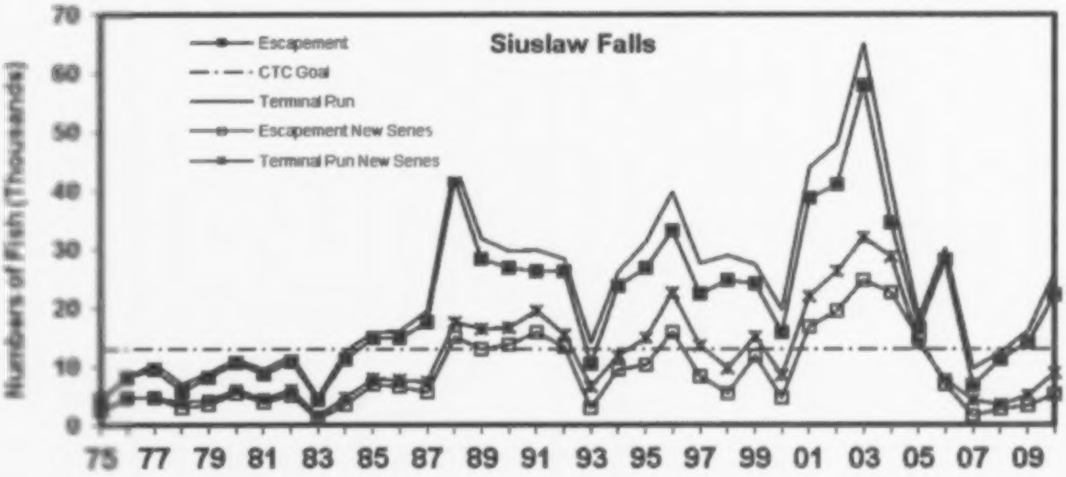
Agency Comments: This stock is being studied by the Sentinel Stock Committee's program to improve escapement estimation. Direct MR adult spawner estimation indicated an escapement of 7,250 Chinook salmon in 2010. Methods comparable to those used to generate the agreed to escapement goal for the Nehalem indicate 2010 escapement of 5,384 adult spawners. This is 77% of the current escapement goal. This is the fifth consecutive year of this stock's failure to meet its agreed-to escapement goal. Due to continued failures to meet the escapement goal, the terminal sport fall Chinook salmon fishery in the Nehalem was closed in 2009. While a terminal sport fishery was conducted in 2011, significant area closures, daily and seasonal bag restrictions were deployed to assist in the rebuilding of this stock. A creel survey program is planned to estimate catches of this terminal sport fishery in 2011. Based on sibling-regression forecasting methods, the Nehalem is forecasted to meet the escapement goal in 2011. ODFW is engaged in analysis to best use results from recent MR experiments to reconstruct historic estimates from peak-counts observed in normative surveys.



Escapement Methodology: Both directed MR study and historically conducted surveys have been utilized to measure escapement during the past return year. Normative estimates are generated from conducting surveys of peak abundance in historically walked predefined areas of known Chinook salmon spawning habitat within the basin. These observations are then multiplied by an estimate of the total available habitat, an accounting for observer biases, an estimate of the total run encountered during the peak, and an estimate of the bias seen between these predefined surveys and those that are randomly selected.

Escapement Goal Basis: The current point goal of 2,944 spawners was derived by Zhou & Williams in 2000 and was based on assessments of escapement made through normative survey methodology.

Agency Comments: This stock is being studied under the auspices of the Sentinel Stock Committee's program to improve escapement estimation. Calibration studies were initiated in the 2009 spawning year, thus traditional methods of escapement estimation remain in place until MR experiment based estimation is complete. The MR study of escapement in the Siletz resulted in an independent estimate of 10,985 adult spawners in 2010. Data used to derive the escapement goal are not directly comparable to MR based estimates of escapement. The estimate based upon historically produced habitat expansion methods for 2010 was 4,225 adult fall Chinook salmon. This is the first year since 2006 in which this stock has achieved its escapement goal (with arguable allowance for relative achievement in 2009). Significant terminal area sport fisheries restrictions which included substantial area closures, restrictive daily and seasonal bag limits are believed to have assisted in the achievement of the escapement goal. Area restrictions are planned to continue to provide a conservative management approach until such time as this stock is believed to be recovered from recent precipitous declines in escapement. This stock is forecasted to exceed its escapement goal in 2011.



Escapement Methodology: Both MR study based calibration factors and historically conducted surveys have been utilized to measure escapement during the past return year. Normative estimates are generated from conducting surveys of peak abundance in historically walked predefined areas of known Chinook salmon spawning habitat within the basin. These observations are then multiplied by an estimate of the total available habitat, an accounting for observer biases, an estimate of the total run encountered during the peak, and an estimate of the bias seen between these predefined surveys and those that are randomly selected. A simple ratio comparison between those years of MR based estimates and observations of peak abundance in normative survey areas has been used to generate a "calibrated" estimate.

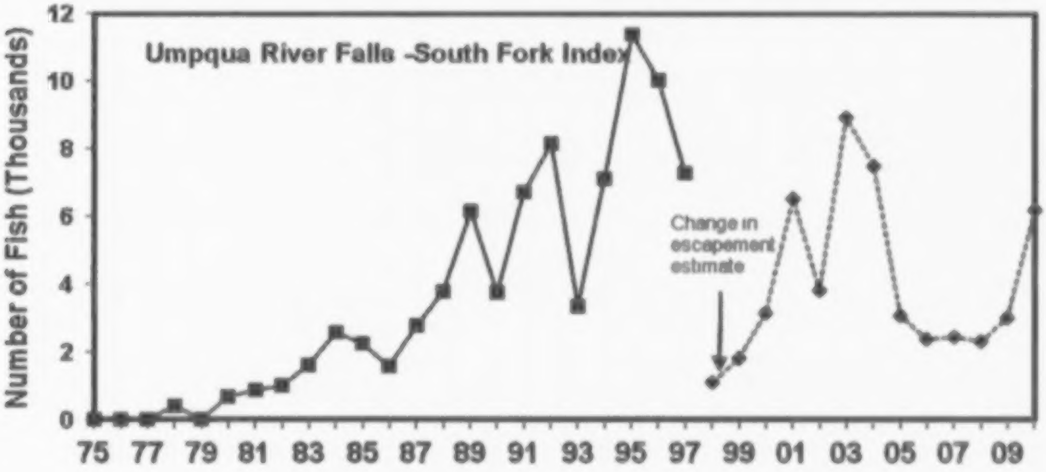
Escapement Goal Basis: The current point goal of 12,925 spawners was derived in 2000 by Zhou and Williams (2001) and was based on assessments of escapement made through normative survey methodology.

Agency Comments: The estimated spawner abundance in 2010 was 5,160 adult Chinook salmon based on methods employing five years (2002-2006) of peak counts on six standard surveys calibrated to MR escapement estimates. The current escapement goal estimate was based upon available habitat expansion escapement estimates, as used in other basins on the Oregon coast, but these estimates and goals have been obviated through the improvement of estimation techniques based upon MR estimates. Escapement estimates based on habitat expansion methods used to generate the agreed to goal result in an estimated 22,197 adult spawners. Spawner-recruit analysis utilizing the MR based data set is planned for the near future to compare between newer escapement estimation (backcast through historical data-sets) and an escapement goal based upon the same data. This stock is forecast to exceed escapement goal in 2011.

2.4.3.3.2 Mid Oregon Coast

The MOC aggregate is currently in proposed status, with analysis and review determining escapement goals for the South Umpqua and Coquille pending. The MOC production is bounded by the Umpqua at the northern range through the Elk basin at the southern extent of the MOC.

After a period of precipitous declines in escapement during 2006 and 2007, the MOC stock aggregate has rebounded to historical averages and above during the 2010 return year. The geographic range of production encompassed by the MOC includes 2 additional major basins, the Coos and Coquille. A smaller contributing basin, the Sixes, is located just north of the proposed exploitation rate indicator stock, the Elk river. Forecasts for this aggregate are based on sibling-regression relationships developed for each discrete population, both indicator and non-indicator stocks. These methods were developed in 2008 and are updated with each year's additional information.



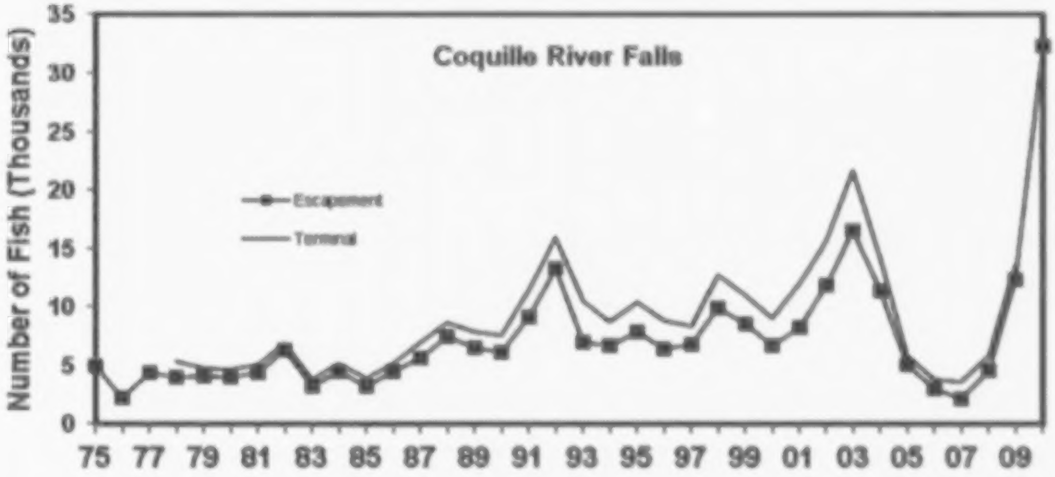
Escapement Methodology: Indices of Chinook salmon spawner abundance in the South Umpqua/Cow creek sub-basin were derived from aerial redd count surveys calibrated to six years of MR study. The aerial surveys are funded by Douglas County and were conducted twice during the spawning season. Aerial redd counts were conducted on the lower 69 miles of the South Umpqua and the lower 60 miles on Cow Creek. These counts cover all mainstem spawning areas for fall Chinook salmon in the South Umpqua Basin. The South Umpqua is broken up into three reaches (Forks to Happy Valley, Happy Valley to Cow Creek, Cow Creek to Milo) and Cow Creek is considered one reach from the confluence with the Umpqua River to Galesville Dam.

Aerial surveys are conducted using a Bell Ranger 3 helicopter; at least two flights are typically scheduled to encompass the peak spawning period. Two biologists simultaneously count redds for each reach using hand tally-counters. At the end of the reach, each biologist will record the number of redds identified, and counters reset for the next reach. The average of the two observers Chinook salmon redd count from reach is used. The index is defined as the sum of the observed average of the peak counts for each reach between the two flights. Expansions are sometimes made to account for portions of reaches that were not completed due to visibility or mechanical problems.

Escapement Goal Basis: ODFW is currently engaged in analysis which will produce an escapement goal for this stock.

Agency Comments: Coded-wire tagged fall-run Chinook salmon from the Umpqua River indicate that they are harvested in PSC fisheries. Four years of U.S. CTC-funded research has allowed the calibration of redd counts to derive a fish per redd expansion factor so that annual escapements estimates can be made. The average expansion factor from these studies is 3.64 fish per redd. The CV (standard error (SE)/estimate aka percent standard error) of the expansion factor was found to be 29%, which would indicate that the average expansion factor is a reasonably reliable statistic to use for annual estimates of escapement. The escapement estimate for 2010 was 6,184 adults based on redd count expansions. This is more than double the escapement observed in the last five years.

Terminal run estimation is currently being conducted and will require some measure of data mining in order to reconstruct historic terminal catch. Preliminary indications are that the terminal catch of South Fork Umpqua Chinook salmon is insubstantial.



Escapement Methodology: Both MR study based calibration factors and historically conducted surveys have been utilized to measure escapement during the past return year. Normative survey methods are identical to those described in the Siuslaw, Siletz and Nehalem basins. A simple ratio comparison between those years of MR based estimates and observations of peak abundance in normative survey areas have been used to generate a "calibrated" estimate. Values presented in the above graph are based on normative survey estimations, not the calibrated values. Both normative and MR calibrated estimates may be found in the appendix tables.

Escapement Goal Basis: ODFW is currently engaged in analysis which will produce an escapement goal for this stock.

Agency Comments: Methods of estimation based on MR calibrated analysis indicate an adult Chinook salmon escapement for the Coquille basin of 41,104 spawners in 2010. Habitat-expansion based estimates indicate an escapement of 32,318 adult fish. This is the largest escapement observed in this basin since surveys were initiated in 1957. Analysis funded by the CTC is underway that will provide information to designate Coquille Fall Chinook salmon as an escapement indicator stock for the Mid-Oregon Coast (MOC) Aggregate. Calibrated index of peak counts on standard surveys to relatively precise MR abundance estimates has been selected as an efficient and cost-effective means to measure spawner escapement of Chinook salmon for use in PST fisheries management.

The U.S. CTC advises a CV of <30% should be achieved in order for an index to be used as an estimator of abundance within the Chinook salmon management scheme. The CV between the qualifying calibration values computed from studies conducted from 2001 through 2004 for the Coquille River basin is 14%, and the average index value of 0.00874. This analysis includes eight standard surveys conducted annually on a regular basis. The calibration value is defined as the average peak count per mile of the eight standard surveys divided by the point value of the Petersen estimate. Peak count is defined as the largest sum of live Chinook salmon and carcasses observed on a particular day, per mile over a defined survey reach.

Improvements in applying those calibrated values towards the estimation of this and other Oregon Coastal stocks are currently being discussed within the agency. It is anticipated that historical time series for each of the basins which have MR calibration studies to draw upon (Nehalem, Siletz, Siuslaw, Coquille) will be updated once consensus is reached and finalized by the next reporting cycle.

3 SENTINEL STOCKS PROGRAM

3.1 Introduction

During recent negotiations within the Pacific Salmon Commission to amend the current Chinook salmon regime under Chapter 3, Annex IV of the Pacific Salmon Treaty, it became apparent that the accuracy and precision of spawning escapement estimates for many important natural stocks of Chinook salmon may not be adequate to support the treaty management process. Reliable estimates of spawning escapements for a large number of natural Chinook salmon stocks over time are critical to assessing and monitoring the status of the resource throughout the treaty area, as well as to determining whether adjustments to particular fisheries are necessary and effective for achieving the long term conservation and production goals of the treaty.

Recognizing the importance of better estimates of Chinook salmon spawning escapements, the Commission conceived the five-year SSP and included it as a specific requirement in the revised Chinook salmon regime (see Paragraph 3(a) of Chapter 3, Annex IV). The SSP is intended to focus on improving spawning escapement estimates for a select subset of important natural Chinook salmon stocks for which existing estimates are critical to fishery management decisions required by the Chinook salmon regime. Improving these estimates will bolster the scientific basis of the Chinook salmon regime, increase confidence in management decisions required under the new regime, and better inform the development of future regimes.

The goal of the SSP is to improve estimates of the spawning escapements for each of the included stocks to a level that meets or exceeds bilateral assessment accuracy and precision standards. Eleven projects were funded in 2010, the second year of the SSP. Summaries for each project are reported in Appendix C.

3.1.1 Northern British Columbia

Skeena River

The return of Chinook salmon to the Skeena River, 93,121 Chinook salmon (CV = 20%), was estimated from the genetic analysis of representative samples collected at the Tyee test fishery and the spawning abundance in the Kitsumkalum River. The SSP funded the genetic analysis of the test fishery samples in order to identify fish originating from the Kitsumkalum River, which was used to estimate the ratio of fish caught in the test fishery to the spawning grounds for the Kitsumkalum River. The total test fishery catch was expanded by that ratio. In 2010, several additional populations were added to the genetic baseline and the 2009 test fishery samples were rerun. These analysis produce a revised estimated of the 2009 return of Chinook salmon to the Skeena River (80,867 fish; CV = 17%). Over the migration period of Chinook salmon into the Skeena River, 451 Chinook salmon were radio-tagged, released and tracked to final destination using 11 mobile surveys and 13 fixed station receivers. The overall stock abundance for the radio tagged Chinook assemblage is similar to the abundance derived from the analysis of the Tyee test fishery collections. This study corroborated the basin-wide escapement estimates produced from the genetic analysis of representative samples collected at the Tyee test fishery and the spawning abundance estimated for the Kitsumkalum River.

Nass River

This SSP project was part of a larger basin-wide escapement program where Chinook salmon were captured and tagged at three fishwheels in the lower Nass River and then recovered and examined for marks at upstream tributaries and two fishwheels at Grease Harbour. The SSP funded the operation of a counting fence on the Kwinageese River, where 2 marked fish were found among the 131 inspected. In 2010, very low numbers of Chinook salmon were caught and marked at the three Gitwinksihlkw fishwheels due to extremely low river discharge during the Chinook salmon migration period. Subsequently, few tags were recovered on the spawning grounds. The MR analysis produced a total spawning escapement estimate of 18,264 Chinook salmon (CV = 25%).

3.1.2 Fraser River

South Thompson River

Spawning escapement to the South Thompson Age 0.3 aggregate was estimated using a combination of genetic, scale age, and CWT information collected from the Northern BC troll fishery and Albion (Fraser River) gillnet test fishery, along with CWT information collected at the Lower Shuswap River. A Bayesian estimation model was used to estimate escapement while considering uncertainty in these information sources. The difference in the spawning escapement estimates based on the Albion (107,000 Chinook salmon; CV = 6%) and Northern BC troll fisheries (214,000 Chinook salmon; CV = 16%) was substantial, and explanation for the difference is currently being investigated; however the prevailing thought is that the Albion test fishery catches may not have been proportional to the size of the South Thompson aggregate over the entire migration period. The spawning escapement to the Middle Shuswap River was 5,038 (CV = 6%), as estimated by MR methods. The fish were captured by angling and released with tags and operculum punches, and subsequent carcass surveys were used to recover marked and unmarked fish.

Chilko River
The spawning escapement, 7,490 (CV = 8%) was estimated using a spatially-stratified MR study design and a Darroch estimator, due to detection of spatial sampling biases. Returning fish were captured by beach seines and angling, and then marked with Peterson tags and operculum punches. Subsequent carcass surveys were used to recover marked and unmarked fish from the spawning grounds.

3.1.3 West Coast Vancouver Island

Kaouk River
This MR program relied on troll and tangle net gear to capture returning fish in the estuary, which were marked with radio tags, t-bar anchor tags at the base of the dorsal fin, and operculum punches. Radio tags were detected in the Kaouk River using a receiver near the tidewater boundary and another used during mobile surveys. Fish were captured in the Kaouk River using beach seines and examined for radio tags and other marks, and untagged fish were released with unique marks to prevent double counting and to distinguish them from radio tagged fish. Recovery of six radio tagged fish produced an escapement estimate of 150 fish (CV = 27%), however at least seven recaptures are required to produce a nearly unbiased escapement estimate (Krebs 1999).

Burman River
This SSP project estimated spawning escapement (3,543 Chinook salmon; CV = 15%) using MR methods. Returning fish were captured with beach seines in the lower river and then tagged and released. Carcasses were recovered upstream at the spawning grounds and examined for tags and secondary marks.

Moyeha River
This study captured and marked live Chinook salmon using beach seines, and then subsequently recaptured them as carcasses. However, a Petersen estimate could not be calculated because no marked carcasses were recovered. A sequential Bayesian method indicated spawning escapement may have been about 690 fish. A lack of tag recoveries prevented evaluation of sampling biases for the tag application and recovery samples.

3.1.4 Coastal Washington

Green River
This study attempted to capture and mark live Chinook salmon using beach seines and then subsequently recapture them as carcasses on all known spawning grounds. However in 2010, high river flow reduced capture efficiencies to zero during the peak and later portion of the Chinook salmon run, which lead to a violation of the equal catchability assumption and too few recaptures. By late September it became clear that the project would not meet its goals, and the carcass recovery survey was modified to support a genetic MR estimate of spawners. The 2010 Green River Chinook salmon escapement estimate will be reported in the next SSP report.

3.1.5 Coastal Oregon

Nehalem River

The spawning escapement, 7,097 (CV = 12%) was estimated using MR methods. Returning fish were captured by using tangle nets and a modified fish ladder, and then marked with operculum punches. Subsequent carcass surveys were used to recover marked and unmarked fish from the spawning grounds. In 2010, the creel survey estimated that 0 tagged fish were harvested by the sport fishery.

Siletz River

This MR program relied on tangle nets to capture returning fish in the lower river, which were then marked with operculum punches. Carcasses were examined for marks at the spawning grounds. In 2010, the creel survey estimated that 0 tagged fish were harvested by the sport fishery. The preliminary spawning escapement was estimated at 10,985 Chinook salmon (CV = 43%). Changes in the habitat at previously successful marking sites and early high water events reduced the numbers of fish marked, and reduced the efficiency of carcass sampling.

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APPENDICES

Appendix A. Landed Chinook salmon catches by region and gear from 1975-2010.

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Appendix A.1 Southeast Alaska Chinook salmon catches.

Year	Southeast Alaska						
	Troll	**Net**	**Sport**	**Total**	**Add-on**	**Terminal Exclusion**	**Treaty Catch**
1975	287,342	13,365	17,000	317,707	-	-	-
1976	231,239	10,523	17,000	258,762	-	-	-
1977	271,735	13,443	17,000	302,178	-	-	-
1978	375,919	25,492	17,000	418,411	-	-	-
1979	337,672	28,388	16,581	382,641	-	-	-
1980	303,643	20,114	20,213	343,970	-	-	-
1981	248,782	18,952	21,300	289,034	-	-	-
1982	241,938	46,992	25,756	314,686	-	-	-
1983	269,821	19,516	22,321	311,658	-	-	-
1984	235,622	32,405	22,050	290,077	-	-	-
1985	215,811	33,870	24,858	274,539	6,246	-	268,293
1986	237,703	22,099	22,551	282,353	11,091	-	271,262
1987	242,562	15,532	24,324	282,418	17,095	-	265,323
1988	231,364	21,788	26,160	279,312	22,525	-	256,787
1989	235,716	24,245	31,071	291,032	21,510	-	269,522
1990	287,939	27,712	51,218	366,869	45,873	-	320,996
1991	264,106	34,864	60,492	359,462	61,476	-	297,986
1992	183,759	32,140	42,892	258,791	36,811	-	221,980
1993	226,866	27,991	49,246	304,103	32,910	-	271,193
1994	186,331	35,654	42,365	264,350	29,185	-	235,165
1995	138,117	47,955	49,667	235,739	58,800	-	176,939
1996	141,452	37,298	57,509	236,259	72,599	8,663	154,997
1997	246,409	25,069	71,524	343,002	46,463	9,843	286,696
1998	192,066	23,514	55,013	270,593	25,021	2,420	243,152
1999	146,219	32,720	72,081	251,020	47,725	4,453	198,842
2000	158,717	41,400	63,173	263,290	74,316	2,481	186,493
2001	153,280	40,163	72,291	265,734	77,287	1,528	186,919
2002	325,308	31,689	69,537	426,534	68,164	1,237	357,133
2003	330,692	39,374	69,370	439,436	57,228	2,056	380,152
2004	354,658	64,038	80,572	499,268	75,955	6,295 1,647	417,019[1] 421,666
2005	338,446	71,618	86,575	496,639	65,294	40,875[2]	390,470[2]
2006	282,315	70,384	85,794	438,493	49,111	26,979[2]	362,402[2]
2007	268,149	55,884	82,848	406,881	69,647	8,730[2]	328,504[2]
2008	151,936	46,149	49,265	247,350	68,163	6,147[2]	173,040[2]
2009	175,644	54,250	69,565	299,459	65,189	3,869[2]	230,401[2]
2010	195,494	33,531	58,503	287,528	55,816	121	231,591

Troll, net, sport and total catches include catch of Southeast Alaska hatchery-origin fish and terminal exclusion catch; catches that count towards the all-gear ceiling (with hatchery add-on and terminal exclusion subtracted) are shown in the "treaty catch" column. "-" = not applicable.

[1] The value on top excludes District 108 Stikine catch above base levels. The value below includes it.

[2] Values updated to reflect removal of Andrew Creek Chinook from the terminal exclusion and to include traditional troll Chinook caught in D108 in the terminal exclusion calculation during years with a directed fishery.

Appendix A.2 Northern British Columbia (NBC) Chinook salmon catches.

Year	Northern British Columbia						
			Tidal Sport				
	Area 1-5 Troll[1,2]	**Area 1-5 Net[2]**	**Areas 1,2E, 2W**	**Areas 3-5**	**Area 1-5 Freshwater Sport**	**Area 1-5 First Nations**	**Total**
1975	228,121	25,095	NA	NA	NA	4,055	257,271
1976	190,267	16,105	NA	NA	NA	2,791	209,163
1977	130,899	44,196	106	1,670	2,158	6,998	186,027
1978	146,054	27,924	125	1,668	6,610	5,363	187,744
1979	147,576	40,640	0	2,523	1,960	5,266	197,965
1980	157,198	26,895	200	3,867	4,515	10,121	202,796
1981	153,065	41,724	184	2,760	2,613	11,115	211,461
1982	173,472	44,844	215	3,760	2,726	13,255	238,272
1983	162,837	17,134	90	4,092	5,374	15,532	205,059
1984	185,134	31,321	171	2,300	3,426	11,408	233,760
1985	165,845	39,562	600	3,600	3,186	15,794	228,587
1986	175,715	23,902	1,153	3,950	4,410	24,448	233,578
1987	177,457	18,357	2,644	4,150	3,625	16,329	222,562
1988	152,369	31,339	7,059	4,300	3,745	21,727	220,539
1989	207,679	38,623	20,652	4,150	5,247	21,023	297,374
1990	154,109	28,359	16,827	4,300	4,090	27,105	234,790
1991	194,018	40,899	15,047	4,256	4,764	23,441	282,425
1992	142,340	35,716	21,358	6,250	6,182	27,012	238,858
1993	161,686	33,944	25,297	3,279	7,813	21,353	253,372
1994	164,581	22,032	28,973	3,171	3,093	15,949	237,799
1995	56,857	18,076	22,531	2,475	3,503	13,635	117,077
1996	8	33,080	670	3,382	1,250	13,345	51,735
1997	84,385	22,355	27,738	0	NA	14,610	149,088
1998	117,147	7,833	34,130	4,750	NA	20,622	184,482
1999	44,900	11,387	30,227	11,700	NA	27,399	125,613
2000	9,948	22,849	22,100	8,600	NA	23,476	86,973
2001	13,351	25,410	30,400	11,000	NA	23,508	103,669
2002	103,021	15,211	47,100	8,000	NA	14,125	187,457
2003	139,862	15,230	54,300	NA	5,711[3]	20,950	287,454
2004	169,306	12,305	74,000	NA	NA	20,548	276,159
2005	174,806	6,850	68,800	NA	NA	17,553	268,009
2006	151,485	12,561	64,500	NA	NA	17,262	245,808
2007	83,235	10,079	61,000	NA	NA	14,087	168,401
2008	52,147	5,938	43,500	11,970	NA	14,963	128,518
2009	75,470	3,083	34,000	9,177	NA	13,083	134,813
2010	90,213	3,141	46,400	7,570	2,689	13,693	163,706

[1] Since 1998, the catch accounting year for troll fisheries was set from Oct 1-Sept 30. To make comparisons to previous years more meaningful, the same catch accounting period was applied for years prior to 1998.

[2] Troll and net catches from 1996-2004 have been updated with data from the Catch Finalization Project.

[3] Estimate of lower Skeena River sport catch only. Note that troll (Areas 1-5) and tidal sport (Areas 1, 2E, 2W) are the components of the Northern British Columbia Aggregate Abundance Based Management fishery. Net catch excludes jacks and small red-fleshed Chinook salmon.

Appendix A.3 Central British Columbia Chinook salmon catches.

Year	**Central British Columbia**					
	Troll[1,2]	**Net[2]**	**Tidal Sport[3]**	**Freshwater Sport**	**First Nations**	**Total**
1975	135,470	40,985	NA	NA	NA	176,455
1976	145,204	32,669	NA	NA	NA	177,873
1977	122,689	32,409	4,773	1,544	6,972	168,387
1978	91,025	35,708	5,694	1,770	7,944	142,141
1979	107,884	50,445	5,225	1,940	7,585	173,079
1980	95,377	27,715	4,802	988	6,240	135,122
1981	69,247	18,912	3,490	1,261	5,701	98,611
1982	69,748	32,419	5,419	1,293	9,112	117,991
1983	97,447	12,556	4,271	821	6,442	121,537
1984	78,120	4,630	4,354	1,332	9,736	98,172
1985	27,090	12,391	3,943	823	6,019	50,266
1986	54,407	23,032	4,566	1,245	6,353	89,603
1987	65,776	10,893	3,933	1,563	6,296	88,461
1988	36,125	12,886	3,596	1,496	6,000	60,103
1989	21,694	6,599	3,438	4,526	8,992	45,249
1990	29,882	18,630	4,053	5,626	9,811	68,002
1991	29,843	15,926	4,409	3,335	8,801	62,314
1992	47,868	18,337	4,891	3,204	8,533	82,833
1993	23,376	10,579	6,114	2,880	9,095	52,044
1994	18,976	14,424	4,303	973	5,383	44,059
1995	5,819	11,007	2,172	1,180	3,501	23,679
1996	0	7,201	2,936	3,986	6,922	21,045
1997	9,274	3,650	8,524	1,139	9,764	32,351
1998	2,188	5,467	5,514	779	6,671	20,619
1999	2,073	4,342	10,300	NA	5,440	22,155
2000	0	3,197	7,400	NA	4,576	15,173
2001	482	6,465	7,650	1,024	5,435	21,056
2002	0	4,676	7,330	723	3,292	16,021
2003	0	2,815	8,385	491	3,173	14,864
2004	0	5,404	10,677	524	4,003	20,608
2005	0	6,323	9,017	809	4,180	20,329
2006	0	5,231	9,400	NA	4,013	18,644
2007	0	5,542	6,130	522	2,102	14,296
2008	9	1,133	2,909	276	3,018	7,345
2009	0	3,132	3,239	0	4,011	10,382
2010	0	1,549	4,043	NA	3,710	9,302

[1] Since 1998, the catch accounting year for troll fisheries was set from October 1-September 30. To make comparisons to previous years more meaningful, the same catch accounting period was applied for years prior to 1998.

[2] Troll and net catches from 1996-2004 have been updated with data from the Catch Finalization Project Net catch excludes jacks and small red-fleshed Chinook salmon.

[3] Freshwater catch included with tidal catch.

Appendix A.4 West Coast Vancouver Island Chinook salmon catches.

Year	West Coast Vancouver Island						
			Tidal Sport	Tidal Sport			
	Troll[1,2,3]	Net[3]	Inside[4]	Outside	Freshwater Sport	First Nations[5]	Total
1975	546,214	19,233	NA	-	NA	NA	565,447
1976	665,010	17,492	NA	-	NA	NA	682,502
1977	545,742	13,745	NA	-	NA	NA	559,487
1978	568,705	25,143	NA	-	NA	NA	593,848
1979	477,222	35,623	7,964	-	NA	NA	520,809
1980	486,303	34,732	8,539	-	NA	NA	529,574
1981	423,266	36,411	11,230	-	NA	NA	470,907
1982	538,510	41,172	17,100	-	NA	NA	596,782
1983	395,636	37,535	28,000	-	NA	NA	461,171
1984	471,294	43,792	44,162	-	NA	NA	559,248
1985	345,937	11,089	21,587	-	NA	NA	378,613
1986	350,227	3,276	13,158	-	NA	NA	366,661
1987	378,931	478	38,283	-	NA	NA	417,692
1988	408,668	15,438	35,820	-	NA	NA	459,926
1989	203,751	40,321	55,239	-	NA	NA	299,311
1990	297,858	29,578	69,723	-	NA	1,199	398,358
1991	203,035	60,797	85,983	-	NA	41,322	391,137
1992	340,146	9,486	46,968	18,518	NA	8,315	423,433
1993	277,033	28,694	65,604	23,312	NA	5,078	399,721
1994	150,039	2,369	52,526	10,313	NA	1,515	216,762
1995	81,454	458	21,675	13,956	NA	5,868	123,411
1996	4	58	2,266	10,229	NA	-	12,557
1997	52,688	5,934	47,355	6,400	NA	5,678	118,055
1998	5,140	345	55,697	4,177	NA	7,172	72,531
1999	7,434	112	47,163	31,106	NA	3,591	89,406
2000	64,547	126	4,468	38,038	NA	-	107,179
2001	79,668	11	6,423	40,179	6,198	-	132,479
2002	126,383	260	36,140	32,115	77	10,785	205,760
2003	146,736	9,251	51,622	23,995	NA	10,000	241,604
2004	171,166	12,348	61,132	42,496	26	16,696	303,864
2005	148,798	23,599	41,710	53,928	6,225	35,000	309,260
2006	109,004	20,308	41,380	37,905	NA	28,628	237,225
2007	94,921	26,881	38,611	46,229	NA	20,098	226,740
2008	95,170	8,257	24,855	50,556	NA	12,159	190,997
2009	58,191	9,765	31,921	66,426	NA	9,026	175,329
2010	84,123	1,747	24,687	54,924	NA	7,485	172,966

Troll: Areas 21, 23-27, and 121-127; net: Areas 21, and 23-27; sport: Areas 23a, 23b, 24-27

[1] Since 1998, the catch accounting year for troll fisheries was set from October 1-September 30. The same catch accounting period was applied for years prior to 1998.

[2] Including 5,000 First Nations troll catch.

[3] Troll and net catches from 1996-2004 have been updated with data from the Catch Finalization Project.

[4] Prior to 1992, catch was not reported as 'inside' or 'outside'. Therefore 'inside' catch for those years represents total tidal sport catch.[5]First Nations catch is mainly commercial catch 1996-2004 has been updated.

Appendix A.5 Johnstone Strait Chinook salmon catches.

Year	Johnstone Strait					
	Troll[1,2]	**Net[2]**	**Tidal Sport**	**Freshwater Sport[3]**	**First Nations**	**Total**
1975	18,065	30,295	NA	NA	NA	48,360
1976	30,838	31,855	NA	NA	NA	62,693
1977	26,868	49,511	NA	NA	NA	76,379
1978	13,052	55,148	NA	NA	NA	68,200
1979	13,052	31,291	NA	NA	NA	44,343
1980	11,743	30,325	NA	NA	NA	42,068
1981	13,035	28,620	NA	NA	NA	41,655
1982	11,234	29,454	NA	NA	NA	40,688
1983	14,653	28,364	NA	NA	NA	43,017
1984	9,260	18,361	NA	NA	NA	27,621
1985	3,567	38,073	NA	NA	NA	41,640
1986	3,951	17,866	NA	NA	NA	21,817
1987	1,780	13,863	NA	NA	NA	15,643
1988	1,566	6,292	NA	NA	NA	7,858
1989	1,825	29,486	NA	NA	NA	31,311
1990	2,298	18,433	NA	NA	NA	20,731
1991	1,228	15,071	9,311	NA	1,287	27,661
1992	2,721	9,571	15,470	NA	29	27,036
1993	4,172	15,530	12,679	NA	20	19,722
1994	2,231	8,991	5,433	NA	0	11,222
1995	4	970	4,296	NA	71	1,045
1996	0	472	3,057	NA	107	579
1997	1,246	1,018	4,047	NA	179	2,443
1998	2,129	328	2,710	NA	138	4,961
1999	273	472	8,985	NA	469	9,027
2000	85	280	5,960	NA	212	6,296
2001	453	332	4,150	NA	370	4,914
2002	129	569	3,696	NA	400	3,429
2003	719	306	9,851	NA	130	8,740
2004	316	525	16,131	NA	28	13,706
2005	2	291	16,076	NA	NA	12,302
2006	0	244	10,532	NA	200	7,682
2007	0	2	9,882	NA	200	9,124
2008	0	48	4,436	NA	324	4,102
2009	0	597	11,501	NA	344	11,717
2010	2	98	10,016	NA	250	10,366

Troll: Area 12 net: Areas 11-13

Sport: Based on July - August creel census in Area 12 and northern half of Area 13

[1] Since 1998, the catch accounting year for troll fisheries was set from October 1-September 30. The same catch accounting period was applied for years prior to 1998.

[2] Troll and net catches from 1996-2004 have been updated with data from the Catch Finalization Project.

[3] Tidal sport creel catches include additional catch estimated using Argue et al, 1977.

Appendix A.6 Strait of Georgia Chinook salmon catches.

Year	Georgia Strait				
	Troll[1,2]	Net[2,3]	Tidal Sport	First Nations	Total
1975	174,001		398,000		572,001
1976	200,229		490,000		690,229
1977	248,082		372,000		620,082
1978	217,955		500,000		717,955
1979	255,057		350,000		605,057
1980	273,077		204,100		477,177
1981	239,266		197,239		436,505
1982	179,040		124,390		303,430
1983	105,133		198,433		303,566
1984	90,280		369,445		459,725
1985	55,888		234,838		290,726
1986	44,043		181,896		225,939
1987	38,084		121,081		159,165
1988	20,224		119,117		139,341
1989	28,444		132,846		161,290
1990	34,304		111,914		146,218
1991	32,412		115,523		147,935
1992	37,250		116,581		153,831
1993	33,293		127,576		160,869
1994	12,916		70,839		83,755
1995	138		62,173		62,311
1996	14	8	89,589		89,611
1997	806	1	56,332		57,139
1998	303	11	20,923		21,237
1999	219	0	43,588		43,807
2000	609	0	32,750		33,359
2001	311	3	31,259		31,573
2002	459	16	52,979		53,454
2003	287	18	19,981		20,286
2004	462	0	13,475		13,937
2005	0	20	11,972		11,992
2006	0	0	12,181		12,181
2007	0	0	14,561		14,561
2008	0	0	8,836	4,848	13,684
2009	0	239	17,884		18,123
2010	5	54	14,942	40	15,041

Troll: Areas 13-18; net: Areas 14-19; sport: Areas 13-18, 19a.

[1] Since 1998, the catch accounting year for troll fisheries was set from October 1-September 30. The same catch accounting period was applied for years prior to 1998.

[2] Troll and net catches from 1996-2004 have been updated with data from the Catch Finalization project.

[3] Georgia Strait Chinook salmon net catch is by-catch from non-target fisheries.

Appendix A.7 Fraser River Chinook salmon catches.

Year	Fraser River Watershed			
	Net[1]	Freshwater Sport[2,3]	First Nations[4]	Total
1975	66,119	7,740	20,170	94,029
1976	73,018	6,354	19,189	98,561
1977	85,222	3,071	23,310	111,603
1978	50,247	3,627	19,541	73,415
1979	51,488	4,450	10,217	66,155
1980	40,061	7	10,528	50,596
1981	22,447	0	8,389	30,836
1982	23,792	96	29,043	52,931
1983	25,580	0	11,875	37,455
1984	27,929	160	17,111	45,200
1985	28,894	596	8,387	37,877
1986	31,401	1,421	12,274	45,096
1987	12,021	3,561	12,050	27,632
1988	8,446	3,702	12,063	24,211
1989	23,443	2,500	4,784	30,727
1990	15,689	2,799	14,180	32,668
1991	14,757	3,116	13,950	31,823
1992	7,363	4,677	10,067	22,107
1993	13,885	3,430	15,395	32,710
1994	13,693	3,195	17,892	34,780
1995	6,451	8,258	17,791	32,500
1996	12,910	7,635	12,665	33,210
1997	40,877	5,051	13,453	59,381
1998	8,292	18,073	14,702	41,067
1999	4,043	8,509	17,999	30,551
2000	8,244	11,727	20,839	40,810
2001	10,398	23,047	18,429	51,874
2002	9,732	24,355	21,796	55,883
2003	11,204	18,014	28,137	57,355
2004	19,224	18,581	31,165	68,970
2005	9,088	22,688	19,832	51,608
2006	7,686	26,662	14,793	49,141
2007	6,795	12,945	13,714	33,454
2008	4,575	18,597	22,417	45,589
2009	7,848	17,485	27,288	52,621
2010	13,953	14,324	15,432	43,709

[1] Fraser River net includes commercial Area E Gillnet, test fisheries, First Nations economic opportunities and scientific licenses.

[2] Freshwater sport catch includes Fraser mainstem and tributary Chinook salmon catch (adults only).

[3] Updated 1975-1980 sport catch from Fraser et al.1982.

[4] First Nations Chinook salmon catch includes food, social and ceremonial from the mainstem and tributaries. Economic opportunity included in commercial net.

Appendix A.8 Canada - Strait of Juan de Fuca Chinook salmon catches.

Year	Canada - Strait of Juan de Fuca				
	Net[1]	Tidal Sport	Freshwater Sport[2]	First Nations	Total
1975	9,799	NA	NA	NA	9,799
1976	13,004	NA	NA	NA	13,004
1977	25,344	NA	NA	NA	25,344
1978	9,725	NA	NA	NA	9,725
1979	8,665	NA	NA	NA	8,665
1980	3,438	37,900	NA	NA	41,338
1981	9,982	29,832	NA	NA	39,814
1982	7,072	30,646	NA	NA	37,718
1983	328	30,228	NA	NA	30,556
1984	6,237	24,353	NA	NA	30,590
1985	17,164	27,843	NA	NA	45,007
1986	17,727	34,387	NA	NA	52,114
1987	6,782	24,878	NA	NA	31,660
1988	4,473	31,233	NA	NA	35,706
1989	21,238	32,539	NA	NA	53,777
1990	7,405	30,127	NA	42	37,574
1991	8,893	19,017	NA	250	28,160
1992	10,023	21,090	NA	302	31,415
1993	2,287	13,967	NA	317	16,571
1994	8,931	14,372	NA	600	23,903
1995	631	14,405	NA	751	15,787
1996	655	19,012	NA	20	19,687
1997	657	17,080	NA	42	17,779
1998	495	9,709	NA	1,500	11,704
1999	771	14,808	NA	52	15,631
2000	199	10,973	NA	272	11,444
2001	439	23,463	NA	135	24,037
2002	345	24,084	NA	NA	24,429
2003	292	26,630	NA	NA	26,922
2004	187	40,877	NA	NA	41,064
2005	153	30,480	NA	NA	30,633
2006	155	26,437	NA	NA	26,592
2007	138	26,549	NA	NA	26,687
2008	172	22,263	NA	NA	22,435
2009	385	25,587	NA	NA	25,972
2010	206	15,612	NA	NA	15,818

Net: Area 20, Sport: Areas 19b and 20

NA=not available

[1] Net catches from 1996-2004 have been updated with data from the Catch Finalization project.

[2] While catch records are poor, in-river sport catch is believed to be small

Appendix A.9 Washington - Strait of Juan de Fuca Chinook salmon catches.

Year	**Washington - Strait of Juan de Fuca**			
	Troll	**Net**	**Sport**	**Total**
1975	5,752	8,048	81,681	95,481
1976	10,488	6,072	75,308	91,868
1977	8,915	14,930	53,238	77,083
1978	10,006	11,224	62,299	83,529
1979	7,804	10,939	67,094	85,837
1980	10,682	11,320	56,415	78,417
1981	15,638	18,541	51,352	85,531
1982	19,024	22,547	29,842	71,413
1983	18,489	16,141	58,060	92,690
1984	15,650	12,120	48,003	75,773
1985	11,808	12,784	44,267	68,859
1986	30,000	17,000	69,000	116,000
1987	45,000	11,000	53,000	109,000
1988	49,000	10,000	39,000	98,000
1989	65,000	10,000	52,000	127,000
1990	47,162	5,294	50,903	103,359
1991	37,127	3,390	39,667	80,184
1992	31,452	927	38,438	70,817
1993	9,794	1,482	32,434	43,710
1994	3,346	5,864	1,661	10,871
1995	6,397	4,769	6,349	17,515
1996	9,757	604	4,825	15,186
1997	829	492	12,238	13,559
1998	338	265	2,159	2,762
1999	544	589	1,990	3,123
2000	332	640	1,670	2,642
2001	1,974	931	4,819	7,724
2002	1,783	1,076	2,028	4,887
2003	436	908	5,290	6,634
2004	20,627	592	4,519	25,738
2005	5,344	175	2,700	8,219
2006	1,115	957	5,695	7,767
2007	4,329	107	6,967	11,403
2008	1,816	4,579	5,804	12,199
2009	3,280	99	11,940	15,319
2010	2,011	2,220	NA	4,231

Troll: Areas 5 and 6C; Area 4B from January 1 - April 30 and October 1 - December 31

Net: Areas 4B, 5, and 6C

Sport: Areas 5 and 6, 4B Neah Bay "add-on" fishery

Appendix A.10 Washington - San Juan Chinook salmon catches.

Year	Washington - San Juan			
	Troll	**Net**	**Sport**	**Total**
1975	3	90,100	31,988	122,091
1976	0	66,832	34,505	101,337
1977	62	84,316	14,049	98,427
1978	3	87,565	15,083	102,651
1979	5	53,750	17,367	71,122
1980	0	64,338	12,231	76,569
1981	4	50,695	9,727	60,426
1982	0	38,763	6,953	45,716
1983	2	28,497	15,166	43,665
1984	83	33,432	25,759	59,274
1985	872	33,579	12,610	47,061
1986	0	21,000	15,000	36,000
1987	0	29,000	14,000	43,000
1988	0	32,000	9,000	41,000
1989	1,000	16,000	9,000	26,000
1990	666	8,608	7,370	16,644
1991	135	11,753	5,115	17,003
1992	172	14,011	6,788	20,971
1993	243	14,002	6,916	21,161
1994	73	13,908	5,795	19,776
1995	9	5,333	7,863	13,205
1996	153	3,934	12,674	16,761
1997	29	29,593	9,155	38,777
1998	376	3,804	3,069	7,249
1999	114	3	3,421	3,538
2000	22	1,091	4,447	5,560
2001	0	970	6,522	7,492
2002	0	2,231	4,827	7,058
2003	0	4,827	3,008	7,835
2004	123	5,184	1,971	7,228
2005	0	4,358	2,703	7,061
2006	0	5,278	4,168	9,446
2007	0	2,621	5,524	8,145
2008	0	48	4,020	4,068
2009	0	1,014	3,896	4,910
2010	0	5,950	NA	5,950

Troll: Areas 6, 6A, 7, and 7A

Net: Areas 6, 6A, 7 and 7A

Sport: Area 7

Appendix A.11 Washington – Other Puget Sound Chinook salmon catches.

Year	Washington – Other Puget Sound		
	Net	Sport	Total
1975	131,982	173,086	305,068
1976	141,281	151,246	292,527
1977	145,470	97,761	243,231
1978	150,298	116,979	267,277
1979	128,073	156,402	284,475
1980	171,516	142,799	314,315
1981	145,152	106,048	251,200
1982	149,274	85,703	234,977
1983	134,492	123,752	258,244
1984	180,248	102,740	282,988
1985	184,907	92,603	277,510
1986	153,000	88,000	241,000
1987	127,000	59,000	186,000
1988	133,000	63,000	196,000
1989	156,000	75,000	231,000
1990	179,593	71,000	250,593
1991	89,495	48,859	138,354
1992	63,460	51,656	115,116
1993	54,968	41,034	96,002
1994	63,577	44,181	107,758
1995	63,593	61,509	125,102
1996	61,658	58,538	120,196
1997	47,522	43,961	91,483
1998	50,915	30,016	80,931
1999	91,947	34,116	126,063
2000	79,494	29,328	108,822
2001	123,266	40,170	163,436
2002	108,566	35,031	143,597
2003	86,206	32,210	118,416
2004	69,211	22,650	91,861
2005	82,629	30,760	108,638
2006	109,557	40,082	149,639
2007	118,628	57,468	176,096
2008	101,322	33,443	134,765
2009	68,764	35,675	104,439
2010	72,576	NA	72,576

Net: Areas 6B, 6D, 7B, 7C, and 7E; Areas 8-13 (including all sub-areas); Areas 74C – 83F
Sport: Areas 8-13 and all Puget Sound Rivers

Appendix A.12 Washington – Inside Coastal Chinook salmon catches.

Year	**Washington – Inside Coastal**		
	Net	**Sport**	**Total**
1975	34,859	1,716	36,575
1976	51,995	2,219	54,214
1977	72,467	2,043	74,510
1978	32,662	3,399	36,061
1979	36,501	2,199	38,700
1980	47,681	1,476	49,157
1981	36,880	786	37,666
1982	33,271	1,114	34,385
1983	16,210	1,452	17,662
1984	16,239	1,319	17,558
1985	25,162	1,955	27,117
1986	29,000	3,000	32,000
1987	51,000	3,000	54,000
1988	74,000	7,000	81,000
1989	85,000	6,000	91,000
1990	57,770	5,000	62,770
1991	54,397	6,070	60,467
1992	64,223	6,577	70,800
1993	59,285	9,180	68,465
1994	46,059	7,454	53,513
1995	46,490	9,881	56,371
1996	55,408	12,059	67,467
1997	28,269	6,619	34,888
1998	20,266	6,569	26,835
1999	11,400	3,165	13,565
2000	15,660	3,179	18,839
2001	19,480	8,645	28,125
2002	23,372	6,038	29,410
2003	18,443	6,075	24,518
2004	21,965	12,088	34,053
2005	20,668	7,051	27,719
2006	27,414	8,030	35,444
2007	12,353	5,066	17,419
2008	15,028	4,006	19,034
2009	18,728	6,724	25,452
2010	12,794	NA	12,794

Net: Areas 2A - 2M; Areas 72B - 73H

Sport: All coastal rivers, Area 2.1, and Area 2.2 (when Area 2 is closed)

Appendix A.13 Washington/Oregon North of Cape Falcon Chinook salmon catches.

Year	Washington/Oregon North of Cape Falcon			
	Troll	Net	Sport	Total
1975	268,971	1,212	265,785	535,968
1976	371,239	203	215,319	586,761
1977	244,491	4	197,563	442,058
1978	150,673	4	104,306	254,983
1979	133,035	3	84,977	218,015
1980	125,709	1,215	59,099	186,023
1981	109,519	209	96,151	205,879
1982	154,720	267	114,952	269,939
1983	63,584	62	51,789	115,435
1984	15,392	0	6,980	22,372
1985	55,408	493	30,189	86,090
1986	52,000	0	23,000	75,000
1987	81,000	4,000	44,000	129,000
1988	108,000	3,000	19,000	130,000
1989	74,600	1,000	20,900	96,500
1990	65,800	0	32,900	98,700
1991	51,600	0	13,300	64,900
1992	69,000	0	18,900	87,900
1993	55,900	0	13,600	69,500
1994	4,500	0	0	4,500
1995	9,500	0	600	10,100
1996	12,300	0	200	12,500
1997	20,500	0	4,100	24,600
1998	20,615	0	2,292	22,907
1999	44,923	0	10,821	55,744
2000	20,152	0	9,242	29,394
2001	54,163	0	25,592	79,755
2002	106,462	0	60,575	167,037
2003	101,758	0	36,513	138,271
2004	88,225	0	27,090	115,315
2005	87,126	0	40,004	127,130
2006	57,313	0	11,176	68,489
2007	38,742	0	9,535	48,277
2008	35,100	0	15,452	50,552
2009	25,410	0	13,331	38,741
2010	89,601	0	38,686	128,287

Troll: Oregon Area 2; Washington Areas 1, 2, 3 and 4: Area 4B from May 1 through September 30 (during Pacific Fishery Management Council management)
Net: Washington Areas 1, 2, 3, 4, 4A
Sport: Oregon Area 2; Washington Areas 1, 1.1, 1.2, 2, 3, 4 and 2.2 (when Area 2 is open)

Appendix A.14 Columbia River Chinook salmon catches.

Year	Columbia River[1]			
	Non-treaty net	**Treaty Indian**	**Sport**	**Total**
1975	323,000	NA	34,870	357,870
1976	288,400	NA	42,527	330,927
1977	255,600	NA	58,838	314,438
1978	189,100	NA	56,582	245,682
1979	169,691	7,865	38,700	216,256
1980	113,569	35,604	15,011	164,184
1981	35,881	54,190	21,151	111,222
1982	94,289	65,447	31,236	190,972
1983	32,877	32,490	23,206	88,573
1984	73,481	61,112	43,760	178,353
1985	74,982	79,036	45,444	199,462
1986	168,038	116,777	57,993	342,808
1987	340,931	152,325	105,835	599,092
1988	341,114	163,295	97,638	602,047
1989	146,739	142,765	88,088	377,592
1990	63,602	91,677	79,465	234,744
1991	53,935	58,855	79,260	192,050
1992	24,063	35,072	56,418	115,553
1993	19,929	40,318	64,995	125,241
1994	2,773	36,141	29,634	68,548
1995	777	42,804	36,547	80,128
1996	17,774	67,040	31,875	116,689
1997	11,268	73,569	46,196	131,033
1998	6,464	47,579	34,533	88,576
1999	10,115	80,368	45,500	135,983
2000	21,414	62,979	48,089	132,482
2001	42,137	167,113	136,174	345,424
2002	71,993	166,175	144,060	382,227
2003	77,457	149,204	141,692	368,353
2004	79,141	153,506	144,888	377,535
2005	45,895	128,897	88,349	263,141
2006	45,481	102,802	67,951	216,234
2007	26,761	56,358	51,220	134,339
2008	52,195	138,653	85,412	276,260
2009	54,983	98,254	83,678	236,915
2010	87,082	184,887	143,472	415,441

[1] The historical time series of catches in this year's report has changed from previous year's report. Catches after 1980 have been broken out into non-treaty net and treaty Indian due to the inability to separate commercial versus non-commercial. Catches from 1975-1980 are consistent for sport and total with the later times series.

Appendix A.15 Oregon Chinook salmon catches.

Year	Oregon		
	Troll	Sport	Total
1975	300	19,000	19,300
1976	1,000	21,000	22,000
1977	3,000	34,000	37,000
1978	1,000	37,000	38,000
1979	800	31,000	31,800
1980	300	22,000	22,300
1981	300	28,000	28,300
1982	500	23,000	23,500
1983	700	19,000	19,700
1984	1,088	27,000	28,088
1985	1,700	25,000	26,700
1986	1,900	33,000	34,900
1987	3,600	46,000	49,600
1988	4,800	49,000	53,800
1989	4,500	45,000	49,500
1990	0	38,000	38,000
1991	0	44,500	44,500
1992	384	39,000	39,384
1993	649	52,000	52,649
1994	371	33,590	33,961
1995	206	48,366	48,572
1996	989	56,202	57,191
1997	513	37,659	38,172
1998	858	37,990	38,848
1999	1,233	30,735	31,968
2000	1,860	33,262	35,122
2001	1,184	54,988	56,172
2002	1,633	61,085	62,718
2003	1,459	67,939	69,398
2004	2,258	71,726	73,984
2005	1,956	27,866	29,822
2006	1,884	39,357	41,241
2007	1,018	25,684	26,702
2008	208	10,780	10,988
2009	293	6,537	6,830
2010	1,315	NA	NA

Troll: late season off Elk River mouth
Sport: estuary and inland
NA = not available

Appendix B. Escapements and terminal runs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks, 1975-2010.

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Appendix B.1. Southeast Alaska and Transboundary river escapements and terminal runs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks. 108

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Appendix B.1. Southeast Alaska and Transboundary river escapements and terminal runs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

Southeast Alaska						
	Situk R.		King Sal.	Andrew Cr	Blossom R.	Keta R.
Year	**esc.**	**term. run**	**R. esc.**	**esc.**	**index esc**	**index esc.**
1975			64	507	146	203
1976	1,421	3,184	99	404	68	84
1977	1,732	2,981	204	456	112	230
1978	808	1,745	87	388	143	392
1979	1,284	3,089	134	327	54	426
1980	905	2,504	106	282	89	192
1981	702	1,857	154	536	159	329
1982	434	949	394	672	345	754
1983	592	1,290	245	366	589	822
1984	1,726	2,948	265	389	508	610
1985	1,521	2,916	175	622	709	624
1986	2,067	2,873	255	1,379	1,278	690
1987	1,379	2,874	196	1,537	1,349	768
1988	868	1,596	208	1,100	384	575
1989	637	1,377	240	1,034	344	1,155
1990	628	1,643	179	1,295	257	606
1991	889	2,095	134	780	239	272
1992	1,595	3,819	99	1,517	150	217
1993	952	2,558	266	2,067	303	362
1994	1,271	6,085	213	1,115	161	306
1995	4,330	14,987	147	669	217	175
1996	1,800	8,100	292	653	220	297
1997	1,878	6,601	362	571	132	246
1998	924	5,420	134	950	91	180
1999	1,461	7,208	304	1,180	212	276
2000	1,785	4,941	138	1,346	231	300
2001	656	2,317	149	2,055	204	343
2002	1,000	3,017	155	1,708	224	411
2003	2,117	6,280	119	1,160	203	322
2004	698	3,218	135	2,991	333	376
2005	595	1,153	143	1,979	445	497
2006	295		150	2,124	339	747
2007	677		181	1,736	135	311
2008	413		120	981	257	363
2009	902		109	628	123	172
2010	167		158	1,205	180	475
Goal Lower	500		120	650	150	175
Goal Upper	1,000		240	1,500	300	400

(continued)

Appendix B.1. (Page 2 of 2).

Southeast Alaska						
Year	**Alsek R. esc.**	**Taku R. esc.**	**Stikine R. esc.**	**Unuk R. esc.**	**Chickamin R. index esc.**	**Chilkat R. esc.**
1975		12,920	7,571		370	
1976	5,282	24,582	5,723		157	
1977	12,706	29,496	11,445	4,706	363	
1978	12,034	17,124	6,835	5,344	308	
1979	17,354	21,617	12,610	2,783	239	
1980	10,862	39,239	30,573	4,909	445	
1981	8,502	49,559	36,057	3,532	384	
1982	9,475	23,847	40,488	6,528	571	
1983	10,344	9,795	6,424	5,436	599	
1984	7,238	20,778	13,995	8,876	1,102	
1985	6,127	35,916	16,037	5,721	956	
1986	11,069	38,110	14,889	10,273	1,745	
1987	11,141	28,935	24,632	9,533	975	
1988	8,717	44,524	37,554	8,437	786	
1989	10,119	40,329	24,282	5,552	934	
1990	8,609	52,143	22,619	2,856	564	
1991	11,625	51,645	23,206	3,165	487	5,897
1992	5,773	55,889	34,129	4,223	346	5,284
1993	13,855	66,125	58,962	5,160	389	4,472
1994	15,863	48,368	33,094	3,435	388	6,795
1995	24,772	33,805	16,784	3,730	356	3,790
1996	15,922	79,019	28,949	5,639	422	4,920
1997	12,494	114,938	26,996	2,970	272	8,100
1998	6,833	31,039	25,968	4,132	391	3,675
1999	14,597	16,786	19,947	3,914	492	2,271
2000	7,905	34,997	27,531	5,872	801	2,035
2001	6,705	46,554	63,523	10,541	1,010	4,517
2002	5,569	55,044	50,875	6,988	1,013	4,051
2003	5,904	36,435	46,824	5,546	964	5,657
2004	7,083	75,032	48,900	3,963	798	3,422
2005	4,478	38,725	40,501	4,742	924	3,366
2006	2,323	42,296	24,405	5,645	1,330	3,039
2007	2,827	14,854	14,560	5,668	893	1,442
2008	1,860	27,383	18,352	3,104	1,111	2,905
2009	6,095	22,806	11,086	3,157	611	4429
2010	9,428	29,307	15,177	4,290	1,023	1852
Goal Lower	3,500	19,000	14,000	1,800	450	1,750
Goal Upper	5,300	36,000	28,000	3,800	900	3,500

Appendix B.2. Northern British Columbia escapements and terminal runs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

Year	Northern British Columbia								
	Area 1 Yakoun R.	Area 3[1] Nass R.			Area 4 Skeena R.		Area 8 Dean R.	Area 9 Rivers Inlet	Area 10 Smith Inlet[2]
	esc.	Above GW[1]	esc.	tot. run	esc.	tot. run	index		
1975	1,500		14,895	17,874	20,319			3,280	960
1976	700		13,819	16,583	13,078			1,640	1,000
1977	800	13,688	14,288	18,410	29,018	39,606		2,225	1,050
1978	600	15,485	16,885	21,807	22,661	35,055	3,500	2,800	2,100
1979	400	11,253	12,783	16,229	18,488	28,166	4,000	2,150	500
1980	600	13,476	14,855	18,744	23,429	38,626	2,000	2,325	1,200
1981	750	12,625	13,925	17,606	24,523	42,018	3,500	3,175	1,020
1982	1,400	7,959	10,359	13,287	17,092	35,185		2,250	1,500
1983	600	13,252	16,301	20,516	23,562	39,510	500	3,320	1,050
1984	300	20,967	24,967	31,408	37,598	53,516	4,500	1,400	770
1985	1,500	17,782	19,694	24,768	53,599	76,544	4,000	3,371	230
1986	500	36,523	38,123	47,967	59,968	87,566	3,300	7,623	532
1987	2,000	19,540	20,986	26,568	59,120	76,349	1,144	5,239	1,050
1988	2,000	15,345	16,715	21,094	68,705	102,563	1,300	4,429	1,050
1989	2,800	28,133	29,175	36,594	57,202	83,439	2,300	3,265	225
1990	2,000	24,051	26,551	33,384	55,976	89,447	2,000	4,039	510
1991	1,900	6,907	8,259	13,136	52,753	79,343	2,400	6,635	500
1992	2,000	16,808	17,408	25,405	63,392	92,184	3,000	7,500	500
1993	1,000	24,814	26,508	36,678	66,977	96,018	700	10,000	500
1994	2,000	21,169	25,689	32,864	48,712	68,127	1,300	3,500	700
1995	1,500	7,844	8,776	16,187	34,390	48,351	1,100	3,196	400
1996	3,000	21,842	22,712	30,889	73,684	96,453	2,000	3,000	250
1997	2,500	18,702	20,584	27,658	42,539	65,350	1,400	4,980	100
1998	3,000	23,213	25,361	34,922	46,744	65,167	3,000	5,367	1,100
1999	3,200	11,544	13,118	22,310	43,775	70,993	1,800	2,739	500
2000	3,600	18,912	20,565	31,159	51,804	77,320	1,200	6,700	500
2001	3,500	29,687	31,915	44,595	81,504	112,346	3,795	5,062	300
2002	3,000	13,773	15,382	21,528	44,771	63,069	3,731	5,031	
2003	4,000	26,940	28,330	36,503	56,758	82,410	3,700	1,900	
2004	4,500	15,912	18,185	25,137	44,243	61,065	3,500	3,950	
2005	5,000	14,363	16,595	24,067	29,067	39,278	2,200	5,585	
2006	NA	24,725	27,743	37,098	33,094	43,689	3,700	3,930	
2007	NA	21,459	25,524	34,221	33,352	44,185	2,300	5,000	
2008	NA	17,862	20,198	26,202	32,963	54,279	1,100	5,792	
2009	NA	28,710	30,334	36,865	38,297	55,921	1,400	4,580	
2010	NA	19,341	20,821	26,052	43,331	54,252	1,600	4,225	

[1] GW refers to Gitwinksihlkw, the location of the lower fish wheels on the Nass River used to capture Chinook salmon for the mark-recapture estimate

[2] The Docee River was dropped as an escapement indicator beginning in 2002 due to an inability to obtain reliable escapement estimates

Appendix B.3. Southern British Columbia escapements and terminal runs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

	Southern British Columbia				
	WCVI		**LGS**		**UGS**
Year	**esc.**	**Nanaimo**	**Cowichan**	**tot. run**	**Esc.**
1975	800	5,475		6,390	
1976	1,075	4,340		5,390	
1977	1,835	6,530		7,590	3,880
1978	2,750	6,495		7,035	6,150
1979	2,048	2,741	7,945	11,209	4,127
1980	5,974	2,982	5,837	10,519	1,367
1981	5,050	225	5,782	7,607	1,945
1982	6,812	1,152	5,034	6,657	3,260
1983	2,700	1,840	4,742	6,862	3,770
1984	3,862	3,178	5,278	8,861	4,600
1985	3,700	914	3,675	5,242	4,600
1986	2,760	958	2,147	3,776	1,630
1987	2,570	757	2,519	3,781	6,450
1988	4,560	1,079	6,878	8,638	3,300
1989	6,220	1,552	5,535	8,142	5,550
1990	3,660	1,397	5,626	7,627	2,320
1991	5,060	935	7,408	8,613	3,340
1992	4,830	1,127	10,250	11,637	5,268
1993	4,530	1,405	7,030	8,730	1,574
1994	4,080	1,072	6,407	7,824	1,237
1995	3,720	2,300	16,449	19,282	4,227
1996	6,020	1,870	14,595	17,275	3,600
1997	7,190	1,772	9,973	11,936	5,266
1998	11,650	1,800	5,858	8,731	10,350
1999	10,190	2,371	6,110	8,714	9,500
2000	4,580	1,446	6,638	8,223	12,850
2001	2,740	2,448	5,015	8,569	9,885
2002	4,290	1,747	4,115	7,812	12,865
2003	4,460	1,672	3,356	5,903	13,978
2004	8,460	550	2,721	3,641	13,365
2005	3,980	1,036	2,467	4,870	13,365
2006	4,580	2,135	1,775	4,880	961
2007	3,820	2,267	2,175	4,778	639
2008	4,320	2,671	2,015	4,926	520
2009	6,990	1,470	785	2,966	798
2010	7,630	2,201	2,879	5,676	624
Goal			6,500		

Refer to List of Acronyms for definitions.

Appendix B.4. Fraser River escapements and terminal runs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

	Fraser River						
	Fraser Spring Age 1.2 esc.	Fraser Spring Age 1.3 esc.	Fraser Summer Age 0.3 esc.	Fraser Summer Age 1.3 esc.	Fraser Spr/sum tot. run	Harrison	
Year						esc.	tot. run
1975	7,179	8,184	26,875	16,875	119,081		
1976	4,600	10,307	4,925	13,630	98,691		
1977	3,675	13,261	19,600	17,240	132,553		
1978	4,305	15,725	16,700	19,200	109,119		
1979	2,770	14,985	18,275	10,205	101,252		
1980	6,255	16,521	8,350	13,625	71,504		
1981	2,975	12,274	13,120	12,202	62,668		
1982	5,510	15,010	6,850	15,088	85,140		
1983	2,641	24,225	9,500	16,604	72,526		
1984	6,380	30,370	15,522	13,595	95,681	120,837	131,740
1985	9,477	43,168	20,375	19,099	121,941	174,778	181,367
1986	10,275	48,446	22,460	32,505	144,617	162,596	177,662
1987	5,049	48,271	22,404	27,646	128,699	79,038	81,799
1988	4,003	41,783	29,567	32,066	129,587	35,116	38,285
1989	6,126	31,994	24,200	16,200	106,843	74,685	76,294
1990	3,225	41,560	25,425	33,747	135,124	177,375	180,837
1991	3,495	27,296	26,250	28,097	116,555	90,638	93,363
1992	5,937	33,038	32,200	38,011	130,249	130,411	132,042
1993	7,870	32,796	13,300	21,385	110,237	118,998	120,600
1994	10,696	51,655	25,350	23,657	145,303	98,334	100,839
1995	9,670	45,237	20,550	26,371	134,478	28,616	29,840
1996	20,726	38,398	50,900	43,142	185,559	37,394	38,568
1997	9,878	44,373	49,250	40,882	202,795	70,514	72,061
1998	3,003	37,862	68,033	36,750	169,333	188,425	189,103
1999	8,751	20,740	53,204	25,138	140,939	107,016	107,884
2000	11,731	26,773	45,161	25,869	155,209	77,035	78,098
2001	10,607	31,512	74,132	33,980	177,008	73,134	74,419
2002	16,423	42,408	85,132	34,886	221,020	89,968	91,122
2003	17,137	45,441	70,164	44,451	231,689	247,121	251,453
2004	12,156	31,614	53,764	30,980	194,440	128,990	138,890
2005	3,898	21,458	88,329	18,586	172,281	86,730	92,993
2006	6,642	21,699	149,928	20,565	242,878	50,942	52,798
2007	1,407	11,737	85,722	10,536	137,206	79,176	83,445
2008	6,121	17,181	106,539	15,431	187,591	41,603	43,798
2009	911	24,150	86,443	20,619	172,858	70,141	75,550
2010	6,576	18,029	156,657	18,229	199,491	103,515	106,777
Goal Lower						75,100	
Goal Upper						98,500	

Appendix B.5. Puget Sound escapements and terminal runs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

Year	Puget Sound (includes hatchery strays in natural escapement)													
	Skagit Spring		Skagit Sum/fall		Stillaguamish		Snohomish		Green		Nooksack Spring esc.		Lake Washington Fall	
	esc.	tot. run	esc.	tot. run	esc.	tot. run	esc.	tot. run	esc.	tot. run	N. Fork	S. Fork	esc.	tot. run
1975	627	627	11,320	30,299	1,198	1,801	4,485	6,627	3,394	6,838			656	1004
1976	633	633	14,120	28,589	2,140	4,241	5,315	10,544	3,140	8,246			719	937
1977	520	520	9,218	21,502	1,475	2,847	5,565	10,676	3,804	5,936			675	889
1978	932	932	13,075	24,285	1,232	2,159	7,931	13,672	3,304	4,766			890	1353
1979	818	818	13,306	24,350	1,042	2,531	5,903	13,743	9,704	11,689			1,289	1578
1980	1,408	1,408	20,058	31,250	821	2,818	6460	17,653	7,743	11,248			1,360	1683
1981	1,045	1,045	8,283	21,817	630	3,014	3368	9,991	3,606	5,532			721	924
1982	753	753	9,910	24,259	773	3,229	4379	9,429	1,840	4,271			885	1384
1983	554	554	8,723	15,758	387	1,089	4549	11,236	3,679	14,376			1,332	2515
1984	696	696	12,628	15,616	374	920	3762	8,975	3,353	5,890	45	188	1,252	4211
1985	2,634	2,634	16,002	26,230	1,409	2,717	4,873	9,637	2,908	7,914	258	445	949	2627
1986	1,922	1,922	17,908	22,906	1,277	2,499	4,534	8,969	4,792	6,114	226	170	1,470	2863
1987	1,745	1,745	9,409	13,387	1,321	1,982	4,689	7,107	10,338	12,283	181	248	2,038	4835
1988	1,743	1,743	11,468	15,262	717	1,222	4,513	7,933	7,994	9,667	456	233	792	2829
1989	1,400	1,809	6,684	13,270	811	1,664	3,138	6,379	11,512	15,244	303	606	1,011	1544
1990	1,511	1,546	16,521	18,950	842	1,743	4,209	8,562	7,035	15,483	10	142	787	1098
1991	1,236	1,273	5,824	8,604	1,632	2,940	2,783	5,151	10,548	15,451	108	365	661	1115
1992	986	1,010	7,348	9,021	780	1,254	2,708	4,448	5,267	10,165	498	103	790	1212
1993	782	812	5,801	7,097	928	1,311	3,866	5,609	2,476	5,507	449	235	245	324
1994	470	496	5,549	5,912	954	1,317	3,626	5,039	4,078	8,368	45	118	888	926
1995	855	887	6,877	9,239	822	946	3,176	3,370	7,939	9,935	230	290	930	966
1996	1,051	1,078	10,613	10,828	1,244	1,249	4,851	4,877	6,026	8,664	534	203	336	362
1997	1,041	1,064	4,872	6,092	1,156	1,185	4,292	4,382	7,101	7,778	520	180	294	302
1998	1,086	1,091	14,609	14,965	1,540	1,557	6,304	6,376	5,963	7,777	368	157	697	711
1999	471	476	4,924	5,229	1,098	1,112	4,799	4,839	7,135	8,376	823	166	778	791
2000	1,021	1,025	16,930	17,265	1,647	1,653	6,092	6,120	4,473	6,880	1,245	284	347	393
2001	1,856	1,866	13,793	14,046	1,349	1,390	8,164	8,464	6,473	9,721	2,209	267	1,269	1555
2002	1,076	1,092	19,591	19,911	1,588	1,598	7,220	7,266	7,564	11,539	3,741	289	637	663
2003	909	987	9,777	10,106	988	1,020	5,447	5,597	5,864	7,871	2,857	204	771	826
2004	1,622	1,622	23,553	24,107	1,506	1,519	10,606	10,701	7,947	13,498	1,746	130	730	794
2005	1,305	1,305	20,803	23,405	963	1,005	4,484	4,680	2,523	2,987	2,167	120	726	788
2006	1,896	1,919	20,768	22,539	1,254	1,279	8,308	8,481	5,790	8,604	1,184	355	1,219	1433
2007	613	613	11,281	13,027	787	791	3,982	4,004	4,301	7,205	1,438	182	1,968	3342
2008	1,472	1,472	11,664	14,995	1,782	1,806	8,373	8,494	5,971	10,290	1,266	318	941	2917
2009	983	983	6,955	12,460	1,130	1,317	2,161	2,347	688	1,067	1,903	294	793	951
2010	1,361	1,537	8,037	9,060	783	785	4,299	4,697	2,092	2,112	2,044	377	729	734

Appendix B.6. Washington Coast escapements and terminal runs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

Year	Washington Coast																	
	Quillayute Summer		**Quillayute Fall**		**Hoh Spr/Sum**		**Hoh Fall**		**Hoko Fall**		**Queets Spr/Sum**		**Queets Fall**		**Grays Harbor Spring**		**Grays Harbor Fall**	
	esc.	**tot. run**	**esc.**	**tot. run**	**esc.**	**tot. run**	**esc.**	**tot. run**	**esc.**	**tot. run**	**esc.**	**tot. run**	**esc.**	**tot. run**	**esc.**	**tot. run**	**esc.**	**tot. run**
1976	1,300	1,700			600	1,300	2,500	3,100			505	737	1,200	2,500	600	1,000	1,836	10,313
1977	3,800	5,300			1,000	2,000	2,100	3,800			732	1,155	3,600	5,500	800	1,700	5,195	14,400
1978	2,300	2,700			1,400	2,472	1,900	2,900			1,110	1,406	2,200	3,100	1,000	1,600	4,555	8,372
1979	2,100	3,900			1,400	2,326	1,700	2,200			870	1,369	3,900	4,700	400	1,100	9,381	10,101
1980	964	1,500	6,700	7,600	800	1,079	2,200	2,800			1,038	1,213	3,200	5,800	200	600	11,656	21,639
1981	815	1,700	5,963	7,102	1,498	2,005	3,100	4,000			988	1,329	4,250	8,200	600	900	7,577	11,915
1982	1,126	2,700	7,107	9,651	1,553	2,125	4,500	5,800			781	1,244	4,150	6,600	610	669	5,606	13,296
1983	548	1,800	3,069	5,530	1,696	2,233	2,500	3,300			1,044	1,173	2,750	4,400	800	850	5,482	8,997
1984	618	1,000	9,128	10,447	1,430	2,005	1,900	2,600			958	1,189	4,350	6,300	1,128	1,130	21,058	22,616
1985	550	700	6,145	8,367	978	1,353	1,725	2,720			677	886	4,150	5,910	1,157	1,159	9,537	15,153
1986	853	1,000	10,006	13,380	1,248	1,912	4,981	6,000	801	839	925	1,193	7,894	9,180	1,795	1,826	13,951	21,534
1987	666	1,600	12,352	20,349	1,710	2,480	4,006	6,147	581	606	598	1,543	6,557	10,638	841	1,071	19,023	30,861
1988	2,599	3,943	15,168	22,115	2,605	3,708	4,128	6,873	784	821	1,765	2,267	9,494	12,505	3,106	3,208	27,216	36,778
1989	2,407	3,472	9,951	17,260	4,697	6,820	5,148	8,682	845	862	2,568	3,954	9,324	12,213	2,068	2,393	25,599	52,777
1990	1,483	1,840	13,711	16,914	3,886	5,294	4,236	6,327	493	498	1,780	2,480	10,569	13,155	1,567	1,630	16,580	36,821
1991	1,188	1,500	6,292	7,631	1,078	1,693	1,420	2,628	1,008	1,024	630	761	4,795	6,593	1,289	1,489	13,432	29,158
1992	1,009	1,271	6,342	7,750	1,018	1,443	4,003	5,139	741	750	375	505	4,911	6,880	1,813	1,851	13,175	24,162
1993	1,292	1,531	5,254	5,735	1,411	2,065	2,280	3,951	894	908	713	788	3,463	5,667	1,254	1,399	11,844	24,487
1994	974	1,187	4,932	5,692	1,699	2,372	3,967	4,322	429	440	705	727	4,233	6,854	1,403	1,479	11,817	24,015
1995	1,333	1,731	5,532	6,716	1,132	1,686	2,202	2,912	929	949	625	662	3,127	5,101	2,070	2,167	9,952	23,570
1996	1,170	1,388	7,316	9,293	1,371	2,083	3,022	4,061	1,256	1,258	776	891	4,218	5,927	4,462	4,655	16,988	26,618
1997	890	1,177	5,405	6,047	1,826	2,582	1,773	3,034	868	888	540	693	2,872	4,945	4,460	4,812	16,342	26,948
1998	1,599	1,829	6,752	7,940	1,287	1,880	4,257	5,388	1,702	1,702	492	537	3,859	5,173	2,388	2,679	11,476	17,368
1999	713	818	3,334	4,758	928	1,081	1,924	2,941	1,550	1,550	373	426	1,918	3,105	1,285	1,555	9,196	10,859
2000	989	1,149	3,730	4,794	492	529	1,749	2,632	730	730	248	250	3,755	4,147	3,135	3,424	8,081	13,010
2001	1,255	1,429	5,136	7,545	1,159	1,231	2,560	4,116	838	838	548	565	3,099	4,808	2,860	3,326	8,340	17,109
2002	1,002	1,100	6,067	9,492	2,464	3,375	4,415	5,716	680	680	738	755	2,589	5,561	2,598	3,217	10,621	13,942
2003	1,219	1,262	7,398	9,469	1,228	1,646	1,649	2,345	1,098	1,098	189	195	4,979	6,618	1,904	2,101	17,808	19,488
2004	1,093	1,189	3,831	6,133	1,786	2,239	3,237	4,410	1,088	1,088	604	619	5,105	6,797	5,034	5,330	29,461	38,161
2005	876	965	6,406	8,319	1,193	1,389	4,180	5,337	284	284	298	306	4,557	6,734	2,130	2,683	17,040	19,599
2006	553	604	5,642	7,646	904	1,061	1,535	2,324	880	880	330	336	3,051	4,258	2,481	2,863	15,955	20,482
2007	502	568	3,066	4,137	810	1,023	1,556	2,427	568	568	352	358	878	1,600	652	999	11,264	15,126
2008	949	1,134	3,612	5,250	671	717	2,849	3,761	483	483	305	305	2,790	4,157	996	1,282	13,570	15,666
2009	464	682	3,130	5,874	880	913	2,081	2,851	385	385	495	495	4,156	5,939	1,133	1,358	7,215	10,832
2010	659	828	4,635	6,431	828	861	2,599	2,941	239	239	382	382	4,022	6,032	3,497	3,704	14,531	18,802
Goal			3,000		900		1,200				700		2,500					

Appendix B.7. Columbia River escapements and terminal runs of Pacific Salmon Commission CTC wild Chinook salmon escapement indicator stocks.

Year	ColumbiaUpriver Spring		Columbia Upriver Summers						Columbia Fall Chinook Salmon						
			Mid-Columbia		Snake River		Total		Lewis River[1]		Deschutes River[2]			Upriver Brights[3]	
	esc.	tot. run	esc.	tot. run	esc.	tot. run	esc.	tot. run	esc.	tot. run	esc.	esc.	tot. run	esc.	tot. run.
1975									13,859	13,859	Mark	Above Falls		29,600	163,753
1976									3,371	3,371	Recapture	Expanded		27,700	108,999
1977									6,930	6,930		7,903	10,658	36,060	85,336
1978									5,363	5,363		5,393	7,908	25,798	77,936
1979	31,381	32,636	16,355	17,238	2,714	2,609	19,069	19,846	8,023	8,023		5,126	7,124	28,926	82,482
1980	32,983	34,090	16,583	17,494	2,688	2,919	19,271	20,413	16,394	16,856		4,106	6,127	27,708	70,743
1981	35,069	36,959	11,569	12,484	3,306	4,385	14,875	16,869	19,297	20,298		6,070	8,411	19,520	58,693
1982	39,930	42,933	8,077	8,958	4,210	4,645	12,287	13,603	8,370	10,126		7,406	10,006	28,313	71,471
1983	31,946	33,355	7,455	7,682	3,895	4,430	11,350	12,112	13,540	14,489		5,491	7,372	45,567	79,113
1984	25,339	27,210	12,213	12,533	5,429	5,016	17,642	17,549	7,132	8,128		4,404	5,790	52,266	127,651
1985	32,263	33,450	12,277	13,258	5,062	3,884	17,339	17,142	7,491	8,241		7,902	10,053	74,206	187,691
1986	40,764	43,329	10,313	11,034	6,154	5,657	16,467	16,691	11,983	13,504		7,467	9,606	93,051	272,949
1987	35,312	37,620	13,240	14,400	5,891	7,200	19,131	21,601	12,935	14,173		6,776	8,620	126,153	409,412
1988	32,629	35,108	12,102	13,010	6,145	8,112	18,247	21,122	12,059	13,636		9,548	12,165	98,220	327,976
1989	32,517	35,230	17,230	17,326	3,169	3,397	20,399	20,724	21,199	22,813		6,338	8,144	83,281	253,233
1990	30,901	33,204	12,983	13,072	5,093	5,123	18,076	18,195	17,506	18,784		2,864	3,887	49,020	149,759
1991	20,471	21,843	9,593	9,715	3,809	3,510	13,402	13,225	9,066	10,354		5,373	5,561	40,132	97,758
1992	34,030	36,248	6,013	6,073	3,014	3,007	9,027	9,080	6,307	7,129		3,668	3,698	41,434	77,311
1993	30,213	32,187	8,514	8,779	7,889	4,287	16,403	13,066	7,025	8,106		8,809	8,817	42,515	94,088
1994	9,289	9,780	11,635	11,812	795	890	12,430	12,702	9,939	10,541		9,556	9,598	66,645	123,214
1995	4,812	5,062	9,063	9,391	692	831	9,755	10,222	9,718	12,155		9,304	9,338	50,595	97,119
1996	19,484	20,562	7,524	7,793	2,607	2,772	10,131	10,565	13,971	13,971		10,233	10,308	53,049	132,882
1997	17,920	19,212	8,464	8,602	10,709	7,536	19,173	16,138	8,670	8,670		20,208	20,337	50,215	141,386
1998	17,452	18,393	9,337	9,549	4,355	4,739	13,692	14,288	5,929	5,929		15,908	16,383	42,113	125,888
1999	11,170	11,710	16,042	16,382	3,260	3,437	19,302	19,819	3,184	3,184		7,389	7,707	43,313	158,044
2000	51,918	55,287	15,033	16,340	3,933	3,919	18,966	20,258	9,820	9,820		4,985	5,321	60,988	150,352
2001	96,017	110,633	32,238	37,610	13,735	14,097	45,973	51,708	13,886	14,186	9,527	12,817	13 033	84,652	219,340
2002	50,836	57,029	60,194	68,721	22,159	19,376	82,353	88,097	16,380	18,230	11,133	11,907	12,727	116,858	264,392
2003	53,315	57,934	53,562	64,742	16,422	16,606	69,984	81,348	18,505	20,505	14,265	13,413	14,384	161,136	358,700
2004	56,953	62,465	36,164	49,909	8,813	10,230	44,977	60,139	15,342	17,133	10,197	10,197	11,421	149,529	356,437
2005	31,728	33,871	35,533	48,759	6,736	7,602	42,269	56,361	11,348	13,348	9,355	14,937	15,735	111,721	252,972
2006	27,832	29,818	34,842	59,158	7,058	12,387	41,900	71,545	10,522	11,999	14,196	10,955	11,659	76,722	215,397
2007	14,368	15,443	14,152	22,944	7,309	10,075	21,461	33,020	3,468	3,606	13,181	6,361	7,583	45,652	99,444
2008	24,918	29,003	17,563	26,310	22,612	22,820	40,175	49,130	5,200	5,200		6,908	7,614	74,386	189,681
2009	29,972	32,496	20,037	32,349	14,482	17,570	34,519	49,919	5,410	5,760		6,429	7,013	85,759	205,035
2010	49,154	58,160	23,994	37,431	28,778	30,002	52,772	67,434	8,701	8,701		9,275	10,013	167,007	314,895
Goal	84,000		17,857						5,700			4,532		40,000	

[1] This is the number of naturally spawning adult fish in the Lewis River The terminal run given is the escapement plus the Lewis River sport catch of wild adults

[2] The first column gives the estimate based on a mark-recapture project for the entire river The second column is the estimate based on mark-recapture at Sherars Falls and using the ratio of redd counts above and below the falls

[3] The 1988 Columbia River Fishery Management Plan included an interim escapement goal of 40,000 natural spawning Upriver Brights at McNary Dam, 38,700 for Hanford Reach and 1,100 Snake River In 1990, this goal was increased to 45,000 for increased hatchery programs In 1995, the escapement goal was reduced to 43,500 In 2002, the escapement goal of 40,000 was agreed to by the Chinook Technical Committee The 2008-2017 U S v Oregon Management Agreement includes a minimum management goal of 60,000 adults for Columbia River and Snake River Upriver Brights combined, including both hatchery and natural production for all areas above McNary Dam The new agreement also includes 43,500 as the minimum Upriver Bright adult escapement, including Priest Rapids brood stock The escapements listed are the McNary Dam count, minus Hanford sport and brood stocks The terminal run is the Columbia River mouth terminal run of Upriver Brights minus the Deschutes River fall Chinook salmon terminal run

Appendix B.8. Oregon Coastal escapements as estimated via traditional habitat expansion methods and terminal runs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

Year	Oregon Coastal							
	Nehalem R.		Siletz R.		Siuslaw R.		Coquille R.	
	esc.	tot. run	esc.	tot. run	esc.	tot. run	esc.	tot. run
1975	5,197	5,303	2,062	2,689	4,427	4,548	4,927	NA
1976	9,807	9,908	1,326	2,036	7,999	8,153	2,188	NA
1977	11,478	12,093	3,314	3,919	9,492	10,362	4,379	NA
1978	12,059	12,244	2,062	3,700	5,872	6,879	3,951	5,290
1979	12,205	12,469	7,217	8,907	8,040	8,799	4,030	4,715
1980	5,555	5,832	3,680	4,820	10,630	11,183	4,014	4,622
1981	10,752	10,939	4,435	6,751	8,724	9,342	4,313	4,996
1982	5,085	5,282	3,415	4,514	10,870	11,774	6,249	6,865
1983	4,431	4,525	2,136	3,152	4,186	4,885	3,193	3,807
1984	20,341	21,623	3,461	4,552	11,168	12,437	4,502	5,164
1985	18,670	19,473	6,628	7,685	14,822	15,805	3,157	3,853
1986	10,389	11,920	6,748	7,799	14,844	15,965	4,470	5,125
1987	13,560	15,725	4,577	6,023	17,603	19,411	5,640	6,997
1988	14,889	17,185	7,805	9,257	41,746	44,380	7,451	8,635
1989	10,389	12,000	4,401	5,980	28,279	31,690	6,462	7,820
1990	5,104	6,789	4,313	5,373	26,799	29,593	6,064	7,567
1991	5,557	7,685	5,633	6,926	26,100	29,825	9,074	11,470
1992	9,060	11,863	6,044	7,460	26,090	28,350	13,293	15,911
1993	5,345	9,317	4,342	6,506	10,446	14,012	6,993	10,419
1994	6,486	9,412	10,475	12,188	23,570	25,890	6,698	8,696
1995	5,194	8,845	5,164	8,045	26,715	31,194	7,885	10,374
1996	9,211	13,285	7,394	10,274	33,051	39,705	6,346	8,790
1997	10,026	13,069	3,726	6,165	22,305	27,516	6,743	8,338
1998	8,245	10,869	5,516	7,175	24,708	28,882	9,930	12,680
1999	8,063	10,632	4,166	6,232	23,963	27,271	8,513	10,950
2000	6,855	9,119	6,787	9,462	15,730	19,588	6,684	8,974
2001	11,662	15,998	10,563	14,704	38,717	43,836	8,233	12,007
2002	18,089	22,657	14,054	19,019	41,058	47,905	11,848	15,578
2003	10,906	15,095	11,149	15,693	58,998	66,246	16,482	21,572
2004	9,975	14,792	3,902	10,419	40,033	46,062	11,346	14,041
2005	8,114	9,535	6,631	8,931	17,618	19,301	5,029	5,767
2006	4,711	5,902	4,108	6,194	28,082	29,926	3,009	3,790
2007	4,304	5,759	528	1,536	6,764	9,665	2,098	3,557
2008	3,810	4,865	1,202	1,682	11,119	12,405	4,562	5,813
2009	4,070	4,070	2,905	3,343	14,094	15,881	12,308	13,530
2010	5,384	7,254	4,225	5,118	22,197	25,846	32,318	NA
Goal	6,989		2,944		12,925		pending	

Appendix B.9. Oregon Coastal escapements and terminal runs as estimated by mark-recapture calibrated indexes of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

	Oregon Coastal						
Year	**Nehalem R.**		**Siuslaw R.**		**Umpqua R. S. Fork**	**Coquille R.**	
	esc.	**tot. run**	**esc.**	**tot. run**	**esc.**[1]	**esc.**	**tot. run**
1975	4,954	5,060	2,567	2,567	NA	6,668	NA
1976	9,345	9,446	4,565	4,565	NA	2,766	NA
1977	10,937	11,552	4,531	4,531	NA	5,676	NA
1978	11,491	11,676	2,867	3,874	400	5,618	6,957
1979	11,794	12,058	3,554	4,313	NA	5,203	5,888
1980	5,368	5,645	5,483	6,036	697	5,952	6,560
1981	10,390	10,577	3,767	4,385	890	6,405	7,088
1982	4,914	5,111	5,094	5,998	1,011	8,885	9,501
1983	4,282	4,376	923	1,622	1,628	4,686	5,300
1984	19,657	20,939	3,384	4,653	2,594	6,229	6,891
1985	18,042	18,845	6,845	7,828	2,246	4,498	5,194
1986	10,039	11,570	6,513	7,634	1,573	5,642	6,297
1987	13,103	15,268	5,568	7,376	2,795	6,429	7,786
1988	14,388	16,684	14,935	17,569	3,778	8,389	9,573
1989	10,039	11,650	12,856	16,267	6,162	6,948	8,306
1990	4,932	6,617	13,662	16,456	3,761	7,738	9,241
1991	5,370	7,498	15,709	19,434	6,717	10,508	12,904
1992	8,755	11,558	13,221	15,481	8,149	16,636	19,254
1993	5,165	9,137	2,960	6,526	3,364	7,446	10,872
1994	6,268	9,194	9,477	11,797	7,128	6,866	8,864
1995	5,020	8,671	10,246	14,725	11,388	12,060	14,549
1996	8,901	12,975	15,788	22,442	10,019	7,618	10,062
1997	9,689	12,732	8,313	13,524	7,286	8,580	10,175
1998	7,967	10,591	5,456	9,630	1,104	11,877	14,627
1999	7,792	10,361	11,785	15,093	1,804	10,653	13,090
2000	8,553	10,817	4,648	8,506	3,140	7,880	10,170
2001	9,957	14,293	16,814	21,933	6,510	12,512	16,286
2002	15,984	20,552	19,400	26,247	3,831	13,675	17,405
2003	19,380	23,569	24,596	31,845	8,918	18,876	23,966
2004	9,639	14,456	22,596	28,625	7,487	11,668	14,363
2005	6,801	8,222	14,884	19,301	3,084	5,438	6,176
2006	11,938	13,129	6,965	7,696	2,396	7,438	8,219
2007	5,193	6,648	1,491	4,154	2,457	2,098	4,037
2008	4,596	5,651	2,617	3,484	2,333	5,803	7,661
2009	5,332	5,332	3,301	5,087	3,014	15,653	16,875
2010	7,250	9,120	5,160	8,808	6,184	41,104	NA
Goal	pending		pending		pending	pending	

[1] Preliminary analysis has shown that terminal catch of South Fork Umpqua River fall Chinook salmon is unsubstantial

Appendix C. Sentinel Stocks Program in 2010.

The Sentinel Stocks Committee met in Seattle during January, 2010 to review progress for projects funded in 2009 and to develop a list of recommend projects for funding under the SSP in 2010. Thirteen 2010 proposals were considered and 11 were recommended for funding in January of 2010. The Pacific Salmon Commission approved funding for all 11 proposals during the February, 2010 meeting. The proposals were chosen as per the approach outlined in the directive from the Commission to the Sentinel Stocks Committee entitled *Implementation Approach for the Chinook Sentinel Stocks Program, October, 2008* and the *Sentinel Stocks Program Second Stage Proposal Evaluation, February, 2009*. Recommended proposals represent stocks in all five regions specified in the directive (North Oregon Coast, Puget Sound, Fraser River, west coast of Vancouver Island, and NBC). The stocks recommended for study in the SSP are of significant importance to the management of fisheries for Chinook salmon under the Pacific Salmon Treaty. In May 2010, the Sentinel Stocks Committee was informed that the project funded in February of 2010 for the Stillaguamish Chinook stock could not go forward in 2010 due to an unforeseen permitting problem. The SSC held a teleconference and considered a revamped 2010 proposal to implement a MR study of the Kaouk River Chinook salmon stock. On May 20, 2010, the SSC recommended the Kaouk study be implemented in 2010 given the funding made available by the cancelled Stillaguamish study and the Commission agreed to the change. Final funded projects and requested budget amounts for the 2010 SSP are summarized in Appendix Table C-1. Summaries of results from these funded projects are provided in the narratives below.

Appendix Table C.1. Projects and funding levels for the Sentinel Stocks Program in 2010.

Stock Group	Stock	Title	2010 Funding
Oregon Coast	Nehalem R.	Nehalem River Chinook Escapement Enumeration	$279,700
Oregon Coast	Siletz R.	Siletz River Chinook Escapement Enumeration	$286,900
Puget Sound	Green R.	Abundance Estimate for Green River Chinook	$128,400
WCVI	Moyeha R.	Moyeha River Chinook Escapement Estimation	$172,300
WCVI	Kaouk R.	Kaouk River Chinook Escapement Estimation	$209,100
WCVI	Burman R.	Burman River Chinook Escapement Estimation	$75,400
Fraser	S. Thompson R.	Abundance Estimate South Thompson Aggregate	$133,100
Fraser	Chilko R.	Chilko River Chinook Mark-Recapture	$264,700
NBC	Skeena R.	Escapement Estimation Skeena River w/ GSI	$35,800
NBC	Skeena R.	Skeena Chinook Radio-telemetry	$417,200
NBC	Nass R.	Estimate of Aggregate Population Upper Nass	$97,900

Refer to List of Acronyms for definitions.

Nehalem and Siletz River Chinook Escapement Enumerations

The Nehalem and Siletz populations of fall Chinook salmon are part of the Northern Oregon Coast (NOC) aggregate. The Nehalem basin is located at the far north of the NOC aggregate, while the Siletz basin is located approximately midway within the NOC aggregate of stocks. The NOC stock aggregate is considered important to both AABM and ISBM fisheries. The NOC aggregate has historically been a very productive, resilient stock complex; however recent failures to reach escapement goals in all three indicator stocks within the aggregate prompted greater interest in quantifying the performance of this group. The prior ten-year average (1990 to 2010) of adult spawning escapement in the Siletz River was 5,839 individuals and in the Nehalem River, the average for the same time period was 7,639 individuals.

ODFW estimated spawning escapement using standard MR methods. Adult fish were captured upon return to each basin using tangle nets in both basins and also a modified fish ladder on the Nehalem River. Fish were marked using operculum punches, the location of which was varied to represent different time frames of freshwater entry. The second capture event(s) occurred on the spawning grounds. ODFW staff surveyed select reaches by foot or by boat and live fish, carcasses, and redds were counted. Carcasses were examined for marks and staff collected biological data from carcasses when possible (length, sex, scales, and other marks). ODFW staff evaluated the likelihood that any MR assumptions were violated using chi-square analyses and Salmonid Population Analysis Software (SPAS). Then, depending on the results of these tests and the data collected, the appropriate estimation techniques were applied. ODFW staff estimated population size from MR data in the Siletz basin using the Chapman version of the Peterson equation. ODFW staff used a stratified estimator (Darroch maximum likelihood, SPAS software) to derive a total estimate for the Nehalem basin. ODFW staff, in part, chose the stratified estimator for the Nehalem because of interest in knowing the relative contribution of the early and late run fall Chinook in the basin. Strata were chosen to represent those runs in terms of timing of freshwater entrance and spawning location. ODFW staff conducted creel surveys in both the Siletz and Nehalem basins. The intent of the creel was to both identify instances when marked fish were removed from the system and to generate a timely and robust estimate of terminal harvest.

Historically, ODFW estimated spawner escapement in Oregon coastal basins using habitat-expansion methodology. Agency and partner employees conducted standard spawning ground surveys to record live and dead counts of Chinook salmon. Then, the largest daily sum of live and dead counts for a given survey location (the peak count) was identified, and an index calculated (number of fish per mile). The index was expanded by the total estimated available

spawning habitat in each basin (in miles). Additional functions are used to adjust for observation and non-random bias. Agency personnel have calculated estimates using these traditional methods while concurrently conducting MR experiments in the Siletz basin since 2005 and in the Nehalem basin from 2000 to 2003 and in 2009 and 2010 (Appendix Table C-2 1).

A total of 93 wild adult Chinook salmon in the Siletz River basin were marked during the 2010 return year. A total of 934 adult carcasses were recovered on the spawning grounds; seven of which were marked (~7% recovery rate). The Chapman version of the Petersen estimator was used to develop an estimate of 10,985 Chinook salmon. Using a bootstrap method to derive an estimate with CIs, an estimate of 12,126 Chinook salmon was derived with a Standard error (SE) = 5,226 and a CV =43.1%. This CV does not meet CTC standards; an inadequate number of fish were marked to develop a robust estimate. One reason for poor first event sampling success may be that the habitat had changed at a previously successful sampling site. This change made the site less conducive to ODFW typical sampling techniques. Also, some early high water events made marking fish less efficient and carcass sampling hazardous.

Appendix Table C.2. Comparisons of Chinook salmon escapement estimates between traditional, habitat expansion methods and mark-recapture (MR) techniques with associated coefficient of variation (CV).

Run year	Traditional estimate	Index (fish/mile)	MR estimate	CV of MR estimate
Siletz River				
2005	6,426	53	11,592	47%
2006[1]	4,108	49	*14,953*	16%
2007	528	5	2,625	16%
2008	1,203	10	1,202	20%
2009	2,905	24	2,213	13%
2010	4,225	35	10,985	43%
Nehalem River				
2000	6,855	51	10,678	26%
2001	11,662	85	12,431	12%
2002	18,089	98	19,956	5%
2003	10,906	77	24,196	22%
2009	4,070	27	5,786	18%
2010	5,384	27	7,097	12%

[1] The 2006 Siletz River mark-recapture estimate is a stratified Darroch estimate; additional analyses are required to assess the influence of potential biases on the accuracy of this estimate.

A total of 254 wild adult Chinook salmon were marked in the Nehalem River basin in 2010. A total of 1,001 qualifying carcasses on the spawning grounds were sampled during the second event. The second event effort included the recovery of 35 marked fish representing a 14% recovery rate. The Chapman version of the Petersen estimator for the Nehalem River basin in 2010 was 7,097 adult fish. An estimate of 7,250 adult fish was developed using the Darroch maximum likelihood approach; this estimate has a SE= 1,120 and a CV=15%, meeting the CTC data standard.

Given future and current constraints around personnel and funding resources, this research has focused on identifying a spawning ground survey protocol using peak counts as the index to track fall Chinook salmon spawner abundance. Previous studies in the Siuslaw and Salmon Rivers correlating various survey indices to a MR derived escapement estimate, suggest that peak counts are the most consistent indicator of abundance when compared to other visual indices. Preliminary analysis of the potential standard surveys located on the main-stem Nehalem and the Siletz River basins have been conducted. Values presented as "*calibration value*" represent the peak count divided by the MR estimate. The ideal conversion factor would have an inter-annual CV= 0 if it tracks perfectly with changes in spawner abundance (Appendix Table C-3). Variability in the inter-annual CV is likely underestimated as this descriptive statistic does not incorporate the precision of the population estimate used, nor does it incorporate the variability within the survey index. Results from standard survey calibration efforts in the Nehalem River basin suggest a relatively strong relationship (CV < 30%) while the relationship in the Siletz River basin is not as strong; (CV between 46 and 68%). ODFW staff hypothesize that one reason for this poor relationship is that the standard surveys in the Siletz and part of the Nehalem represent smaller, tributary type habitat which is not typically productive Chinook habitat. In basins where the relationship between the standard surveys and the MR estimate is strong (i.e. Siuslaw and Salmon Rivers), the standard surveys occur in habitats more typical of Chinook spawning habitat. Therefore, with funding support through SSP, ODFW continues to explore a survey design and estimation method that uses both main-stem and larger tributary reaches outside the historical standard survey design. Preliminary results from these "Select" survey reaches are promising (Appendix Table C-4). Bias detected in some of the MR estimates may exclude these abundance estimates from the calibration analysis, thus additional studies may be necessary to improve confidence in the abundance-index relationship.

Appendix Table C.3. Calibration of adult (>600mm) Chinook salmon encountered on standard surveys to mark-recapture (MR) estimates in the Siletz and Nehalem River basins. Coefficient of variation (CV) values represent the variation around the annual calibration values beginning at the third consecutive year of M/R estimation.

	Siletz River Basin				**Nehalem River Basin**			
Run year	**Peak count/mile**	**Calib. value**	**MR estimate**	**Calib. CV**	**Peak count/mile**	**Calib. value**	**MR estimate**	**Calib. CV**
2000	49	NA	NA	NA	51	0.00478	10,678	
2001	77	NA	NA	NA	85	0.00684	12,431	
2002	102	NA	NA	NA	98	0.00491	19,956	0.21
2003	81	NA	NA	NA	77	0.00362	21,283	0.30
2004	28	NA	NA	NA	64	NA	NA	NA
2005	53	0.00457	11,592		45	NA	NA	NA
2006	49	0.00290	14,953		30	NA	NA	NA
2007	5	0.00175	2,625	0.46	27	NA	NA	NA
2008	10	0.00798	1,202	0.63	24	NA	NA	NA
2009	24	0.01096	2,213	0.66	27	0.00470	5,786	0.23
2010	35	0.00316	10,985	0.68	27	0.00380	7,097	0.24

The ODFW intends to identify a cost effective spawning ground survey design in which one or more of the measured metrics accurately and precisely represent Chinook spawner abundance for the basin within the data standards developed by the CTC. The current focus is to increase the proportion of main-stem type habitat surveyed. ODFW has confidence that they can identify survey reaches in which fish counts will more consistently track the spawner estimate derived through the MR component of this study, regardless of run strength or water levels. The intent is to survey select main-stem or large tributary reaches annually throughout the duration of the studies. This analysis will require multiple years of statistically sound MR experiments before a complete assessment of survey results can be performed with acceptable levels of certainty. ODFW is also exploring a weighted least squares regression approach to determine the relationship between a visual index and the MR estimates of abundance. This technique may allow researchers to include study years where the abundance estimates did not meet the precision standards necessary for the calibration approach. Using this approach, annual spawner escapement could be estimated from the regression equation and confidence bounds derived using peak count data.

Appendix Table C.4. Calibration of adult (>600 mm) Chinook salmon encountered on three select surveys to mark-recapture (MR) estimates in the Siletz River basin. The coefficient of variation (CV) represents the variation around the annual calibration values beginning at year three.

Run year	Peak count/mile	MR estimate	Calib. value	Calib. CV
2005	101	11,592	0.008675	NA
2006[1]	80	*14,953*	0.005353	NA
2007	13	2,625	0.005074	0.32
2008	8	1,202	0.006411	0.26
2009	22	2,213	0.009214	0.29

[1] The 2006 Siletz River mark-recapture estimate is a stratified Darroch estimate; additional analyses are required to assess the influence of potential biases on the accuracy of this estimate.

Abundance Estimate for Green River Chinook

Seven Chinook stocks in Puget Sound are used as escapement indicator stocks by the CTC. The U.S. CTC determined that escapement estimates in Puget Sound fail to meet U.S. CTC data standards. Shortcomings relative to data standards include the lack of usable age, sex, and length data from surveyed streams, the use of unverified expansion factors primarily for redd surveys, and the absence of variance estimates.

The average Green River Chinook salmon escapement from 2000 to 2009 based on redd counts is estimated to be 10,387 fish. The spawning abundance of Chinook salmon in the Green River system, has historically been estimated from redd counts in conjunction with four key assumptions: (1) for area-under-the-curve estimates in mainstem areas, an individual redd is assumed to be visible for 21 days (or occasionally a basin-specific estimate generated through redd life monitoring has been used); (2) for marked-redd censuses in tributaries, all redds are assumed visible and remain marked, and false redds are assumed to either remain unmarked or are marked at a known, consistent rate; (3) each spawning female is assumed to construct only one redd; and (4) 2.5 spawning Chinook are assumed to be associated with each redd (1.5 males/female). The Chinook escapement to the Green River has historically been estimated as the sum of five components: (1) Raft Index Area (RM 41.5-43.0) within which a count of all unique redds is made; (2) Raft Supplemental Area (RM 35.0-41.5) within which the redd counts are estimated by multiplying the redd count in the Raft Index Area by the ratio of peak visible redds in the Raft Supplemental Area over the peak visible redds in the Raft Index Area; (3) Newaukum Creek, which uses a method similar to the Raft Supplemental Area method; (4) Aerial Survey Area (RM 29.6-47.0 and RM 56.0-61.0, excluding raft areas) within which an aerial correction factor is computed as the average ratio of the peak number of redds in the raft areas as counted in the aerial surveys and in the raft surveys (then the number of redds are estimated by multiplying the aerial correction factor and the peak aerial count of redds by the ratio of the unique redds over peak visible redds in the Raft Index Area; and (5) Soos Creek within which the escapement downstream from the hatchery rack is estimated as the sum of all carcasses, plus any live fish counted on the last survey and any fish passed above the hatchery rack.

The project goals for the 2010 study were to: (1) provide an unbiased estimate, via MR, of the number of adult Chinook salmon (≥ age 3) passing upstream of ~RM 26 in the Green/Duwamish River that spawned naturally, such that the estimate is within ±30% of the true value 95% of the time; (2) provide an unbiased estimate of the age 2 "jack" male population, such that the estimate is within ± 50% of the true value 90% of the time; and (3) develop potential predictive estimators of abundance for future application (beyond the SSP research period), by calculating ratios of MR estimates of abundance to various redd and fish counts or area-under-the-curve estimates. In 2010, the Green River project was not successful in achieving its goals due to higher than normal flow, which occurred from late September through October. These flows reduced capture efficiencies for adult Chinook salmon to zero during the peak and later portion of the Chinook salmon run. This led to a violation of the equal catchability assumption and too few recaptures, which caused this project not to meet its goals.

It became apparent to the Washington Department of Fish and Wildlife that it was unlikely the Green River project would meet project goals by late September, and action was taken to modify the carcass recovery to support a genetic MR estimate of spawners. This methodology was developed in 2010 and was used with success on the Coweeman stock in a study funded through the U.S. Letter of Agreement. During the 2010 recovery event, a genetic sample was obtained from Green River Chinook salmon carcasses. This sample when analyzed along with genetic samples collected during the 2011 juvenile outmigration will allow WDFW to develop an estimate for 2010 spawners by coupling MR estimators and genetic parentage methods. The 2010 Green River Chinook salmon escapement estimate will be reported in the next SSP report.

Moyeha River Chinook Escapement Estimation

Moyeha River Chinook salmon contribute to the SEAK, NBC, and WCVI AABM fisheries managed under the Pacific Salmon Treaty. The Moyeha River is located in Strathcona Park, Clayoquot Sound, on the west coast of Vancouver Island. The Moyeha River was chosen as a candidate for the SSP for the following four reasons. Habitat in the Moyeha River watershed is pristine and untouched by development. The population has never been purposely enhanced by hatchery supplementation. The stock contributes to the PSC eleven-stream WCVI Chinook salmon escapement index. Moyeha Chinook belong to the South West Vancouver Island Chinook CU, while the Burman and Kaouk populations belong the Nootka-Kyuquot CU. Prior to the SSP, area-under-the-curve index surveys from 2000 to 2009 indicated that escapement averaged 130 Chinook salmon. The objectives of the project were to: (1) estimate total escapement of age-3 and older Chinook salmon; (2) estimate the proportions of age-3 and older Chinook salmon by age, sex, size and origin; and (3) compare this result to the normative AUC_{index} developed annually using snorkel survey methods.

The intended estimate of escapement in 2010 was to be based upon a two event MR experiment focused on age-3 and older Chinook salmon. During the first event, a seine net was deployed using a boat in the Moyeha River approximately 1.75 km and 2.00 km upriver within staging pools. Captured Chinook were tagged in both opercula with numbered Kurl-lock tags and biological samples were obtained. Chinook were visually identified by gender and post-orbital hypural (POH) lengths were measured to the nearest 5mm. Scales were obtained for ageing. A mutilation mark was applied in the right or left operculum depending on when the salmon was tagged. Tissue samples were preserved to contribute to the coast-wide GSI database. Chinook recovered live by beach seine that had been previously tagged were recorded along with any other species captured. A total of 27 individual Chinook were caught during the first event; 3 Chinook were caught twice. Carcass surveys were conducted over the entire anadromous reach from river km 13.5 to the river mouth. Recovered carcasses were sampled for biological data; otoliths were collected for origin determination. A total of 14 carcasses were recovered; none were fish marked during the first event. A total of 12 carcasses had otoliths removed; one otolith sample was destroyed in the lab during processing. The gender of each Chinook carcass was identified; POH lengths to the nearest 5mm were recorded. Egg retention in females was estimated to assess handling stress.

A Peterson estimate could not be calculated because no marked carcasses were recovered. Instead, an estimate was developed using a sequential Bayesian method from data obtained from the marking event, carcass survey, and re-sight information from the tagged Chinook observed in CDFO swim surveys. The assumption of a closed population was made, although not verified. The Bayesian analysis estimate using exclusively adult data (removing jacks) produced a modal population estimate located at 684– 692 Chinook salmon (95% highest probability density) and there was a 95% probability that the escapement was at least 440 individuals. Although the data were sparse, this represents a direct probability statement of population size. The potential for introduction of bias through failure to assess tag loss (no marked carcasses were recovered) was addressed by simulation of tag loss rates. In the most extreme case assessed, assuming the loss of 29% of tags, less than a 3% reduction in population resulted. It is reasonable to conclude that bias from unequal capture probabilities through mark loss was not a substantive source of error in the estimate of escapement.

The ratio of males to females sampled was 1.88:1.00 during the seining event and 2.50:1.00 for the carcass recoveries with a pooled ratio of 2.08:1.00. The age structure proportions were 0.313 (SE = 0.083, CI = 0.165 to 0.524) age-3, 0.219 (SE = 0.74, CI = 0.101 to 0.435) age-4, and 0.469 (SE = 0.090, CI = 0.291 to 0.656) age-5. Origin proportions determined from otolith examination (n =11) were 0.455 (SE = 0.157, CI = 0.170 to 0.777) naturally spawned salmon and 0.545 (SE = 0.157, CI = 0.231 to 0.823) hatchery strays from the Conuma Hatchery. The hatchery strays were predominantly 3-year old males. Lengths were similar between Chinook caught during the seining event and obtained in the carcass surveys ($D_{,} = 0.182$, $P = 0.985$).

The normative area-under-the curve index from the snorkel surveys provided by CDFO was 185 large Chinook with a peak observation of 162 individuals. We were not able to develop an expansion factor for a Peterson estimate, but the expansion factor between the snorkel based normative estimate and the Bayes 0.95 probability minimum estimate was 2.38.

Considerably more effort is required to mark sufficient fish to generate a reliable estimate of escapement using the Petersen method in the future. An increase in marking effort employing additional capture methods and increased carcass recovery effort is required to achieve the CTC data standard of a CV of <15%. Larger origin and age sample sizes are required to estimate proportions more precisely.

Kaouk River Chinook Escapement Estimation

A study of the Kaouk River Chinook salmon stock was conducted in 2010 to estimate the escapement of age 3 and older fish and to estimate the sex, age and length structure of the run. The Kaouk River, located on the west coast of Vancouver Island, British Columbia, is one of three of the six indicator streams for the area identified in the Pacific Salmon Treaty that has never received direct hatchery enhancement. Assessments derived from the normative area-under-the-curve index program on the Kaouk River have estimated escapements that range from 110 Chinook in 2000 to 820 Chinook in 1998 with the ten-year (2001-2010) average estimated at 350 Chinook salmon.

A MR study (Petersen model) was conducted to develop a 2010 escapement estimate. An alternative estimate was also examined using maximum likelihood procedures. Three marks, including a radio tag, were applied to fish in the estuary using troll and tangle net gear. Fish that entered the lower river at the survey boundary were counted as marks (M) by one of two fixed telemetry receivers. Live captures (C) and recaptures (R) occurred in the river using a large beach seine after fish had migrated upstream from the estuary; telemetry surveys were conducted to test for population closure and to examine tag loss and nose-in rates. Carcass surveys were conducted to recover marked and unmarked fish. Biological data and encounter histories of all live and dead marked and unmarked fish were collected.

Twenty-two of the Chinook marked in the estuary entered the Kaouk River (M=22). A total of 45 Chinook were captured by beach seine in the Kaouk River (C=45) including six with radio tags (R=6). The total escapement for 2010 using the Petersen model was 150 Chinook salmon (95% CI: 74-369; CV=27.3%). Alternative estimates of 111 Chinook (95% CI: 71-212; CV=30%) and 114 Chinook (95% CI: 72-218; CV=30%) were derived using maximum likelihood procedures. The CTC standard of CV ≤15% was not met. The precision standards for age and length structures (i.e. estimated values within 10% points of the true value 95% of the time) were not met for age but were met for length. Population closure was likely not met due to the influence of a large storm event on September 25, 2010, and high river discharge through much of October.

A MR approach to estimating escapement had not previously been attempted in this river system. One of the goals of this approach is to eventually use the results of the Petersen estimate to improve the normative area-under-the-curve index program, used to derive an annual escapement estimate for the Kaouk River. Further, by incorporating robust approaches to the sampling design of future MR surveys, alternative maximum likelihood methods can be paired with existing protocols to produce additional estimates. The replication of studies that accommodate the use of multiple models will in turn lead to the creation of correction and calibration factors, which will provide greater accuracy and precision in future escapement estimates.

Burman River Chinook Escapement Estimation

The WCVI fall Chinook stock aggregate is an important production group contributing to catches of Chinook in Alaskan and Canadian AAABM and ISBM fisheries. The stock group includes four CUs, described under the Canadian Wild Salmon Policy, occupying the west coast of Vancouver Island. Burman River Chinook belong to the Nootka-Kyuquot CU. The Burman River Chinook population is an escapement indicator described in Attachments I-IV to the Chinook Chapter of Pacific Salmon Treaty. Estimated escapements to the Burman River are summed along with the estimated escapements to five other streams to produce a six-stream index representing WCVI escapement trends. The Burman escapement estimate is also included in a second larger index that includes eight additional WCVI streams.
Exploitation of the aggregate is assumed to be represented by the Robertson Creek Hatchery CWT exploitation rate indicator stock. Low stock status of the WCVI stock group has prompted fishing restrictions in Canadian fisheries since 1995. Over the last 11 years (2000 - 2010) escapements to the Burman River averaged 967 adult Chinook. Conservation concerns for the WCVI stock group and other southern stocks prompted a 15% reduction in the Chinook catch levels in SEAK fisheries in the 2009 Pacific Salmon Treaty. The catch reductions are to be reviewed in 2014 (Paragraph 6 (c)). In the interim, Canada and the U.S. agreed to implement a SSP for five years to improve the precision and accuracy of Chinook escapement estimates, including those in the WCVI area.

The objectives of this study were to: (1) estimate the escapement of age-3 and older Chinook salmon returning to the Burman River to the CTC data standard (CV of ≤15%, on average) using a two-event Petersen MR experiment; (2) estimate the proportions of the escapement by age, sex, size and origin (hatchery and wild) with a 95% probability of detecting a 5 % change in the largest component between years; and, (3) compare MR and snorkel based AUC $_{index}$ estimates of escapement.

Chinook escapement was estimated with a 2-event MR experiment aimed at age-3 and older Chinook. Chinook salmon were captured and marked using a beach seine in the lower river staging area and marks were recovered during systematic carcass surveys over the entire spawning area. Biological samples and marks were also recovered from two hatchery brood collections. All Chinook captured, with the exception of fish released unmarked during the hatchery brood collections, were marked with two individually numbered #3 Kurl-lock tags attached to the opercula and a secondary mutilation mark. Fish were identified by gender, and post-orbital hypural length was measured. Scales were collected for ageing and otoliths were recovered from carcasses and hatchery brood collections to determine origin.

Between September 7 and October 18, 2010, a total of 733 adult Chinook salmon (165 females and 568 males) were marked in the lower river staging area and remained at large after marked fish removals in hatchery brood collections were deducted. A total of 168 carcasses were sampled of which 34 were marked during the first event of the experiment. The hatchery program removed 187 adult Chinook that are not included in the Petersen estimate. The Petersen estimate of age-3 and older Chinook was 3,543 fish (SE = 513, CV = 14.5%). The estimate met the program precision standard because of the planned 50% increase in marking and recovery efforts combined with a larger escapement in 2010. Adding the brood removed yields an estimate of 3,740 adults (SE = 513, CV = 14.5%). The bootstrap mean was 3,491 (SE = 5,596) suggesting a 1.4 % positive statistical bias in the estimate although the re-samples were not normally distributed. Further analysis is required to determine the cause of the bimodal distribution which suggests two populations were present. The 95% CI taken directly from the bootstrap re-samples was 1,915 to 5,737. The Petersen estimate from jacks was 421 fish (SE = 2,219, CV = 54%), but because it is based upon recovery of a single marked carcass is not reliable.

The Petersen estimate was not affected by tag loss as all previously marked fish were recognizable by the secondary mark albeit not as individuals. We assumed the population on the spawning grounds was closed based on past information. All animals encountered were double checked for marks by two observers and carcasses were destroyed after sampling to prevent double counting. Gender and size selectivity were absent indicating an unstratified Petersen estimate was appropriate. Tagged males (0.043) were recovered at a lower rate in the carcass survey than marked females (0.063), but the difference was not significant (X^2= 0.491, df = 1, α = 0.05, P = 0.483). There were no significant differences between the cumulative length frequency distributions of all fish marked at the lower river site and either the lengths of all carcasses recovered (D, = 0.200, P = 0.975) or marked carcasses (D, = 0.1000, P = 1.000).

The ratio of males to females was 3.40:1.00. Ages of adult fish obtained from the brood stock sample were highly different than the ages of newly marked fish (X2 = 43.542, df = 1, P = <0.0001) and were not pooled with age samples obtained during marking. Ages obtained from 400 Chinook during sampling in the lower river were used to estimate age composition as they were collected systematically over the course of the project. Age-3 males were the most abundant followed by age-4 fish in 2010. The proportions at age overall were 0.678 (SE = 0.023) age-3, 0.24 (SE = 0.021) age 4, 0.075 (SE = 0.013) age-5, and 0.008 (SE = 0.004) age-6. Stream-type Chinook were not observed in the 2010 sample. The proportions by age for males were 0.630 (SE = 0.024) age-3, 0.142 (SE = 0.018) age-4, 0.033 (SE = 0.009) age-5 and no age-6 fish. The proportions by age for females were 0.048 (SE = 0.011) age-3, 0.098 (SE = 0.015) age-4, 0.043 (SE = 0.010) age-5, and 0.008 (SE = 0.004) age-6. The large proportion of age-3 males may have caused the bimodal bootstrap distribution.

Origin proportions estimated from thermal otolith marks were 0.055 (SE = 0.012) naturally spawned and the remainder originated from hatcheries: 0.844 (SE = 0.002) of the total were from the Burman River hatchery program; and 0.100 (SE = 0.016) had strayed principally from the Conuma Hatchery. The origin proportions of wild and all hatchery fish in 2010 were not significantly different (X^2 = 0.512, df = 1, P = 0.474) than that observed in 2009 (n =

347). The origin proportions of natural, Burman River hatchery, and hatchery strays in 2010 were significantly different ($X^2 = 66.31$, $df = 2$, $P < 0.0001$) than in 2009 due to fewer hatchery strays and a larger Burman hatchery contribution.

The normal area-under-the curve index snorkel survey estimate for 2010 was 3,028 age-3 and older Chinook, including hatchery brood. Survey life was assumed to average ten days, and observer efficiency was estimated to be 80%. The snorkel based estimate is preliminary and subject to revision. Adding the brood removed downstream to the Petersen estimate yields 3,740 adults ≥age-3 (SE = 513, CV = 14.5). The expansion factor between the snorkel based estimate and the MR estimate was 1.23 in 2010. The long term intent of the Burman River escapement program is to develop an expansion factor for the snorkel based estimates within the data standard. This was the second year of the MR program designed to estimate an expansion factor. At least one more MR experiment will be required to evaluate the precision of the expansion factor. Sampling effort in the river and carcass surveys were increased by 50% in 2010 over the 2009 effort and appears sufficient to obtain the desired level of precision provided the escapement does not decline.

Abundance Estimate South Thompson Aggregate

A Bayesian model was developed to estimate the escapement of an aggregate salmon stock based on genetic stock identification data and recoveries of CWTs from a hatchery indicator stock in distant fisheries and on the spawning grounds. This model was applied to data from 2009 for the South Thompson Age 0.3 Chinook Aggregate, a significant component of the Fraser early model stock used by the CTC. The expected escapements for the South Thompson aggregate, based on data from the Fraser River gillnet test fishery (Albion) and NBC troll fishery were 169,000 (CV=0.06) and 155,000 (CV = 0.17), respectively. In 2010, the analysis was repeated using data from the same two fisheries collected within the same year. The expected escapements based on the 2010 data from the Fraser River gillnet test fishery (Albion) and NBC troll fishery were 107,477 (CV=0.06) and 214,434 (CV = 0.16), respectively. The spawning escapement for the Middle Shuswap River, estimated by MR methods, was 5,038 (CV=0.06) in 2010.

For 2009, the differences in the two estimates were minor and well within variation due to sampling error. Age-specific estimates of escapement were relatively precise in cases where the uncertainty in the expanded number of CWT recoveries in the fisheries was low. For 2010, the differences between the two estimates were pronounced with the Albion test fishery derived estimate being about one-half that produced when using NBC troll fishery data. The explanation for such a large difference between the estimates is currently being investigated; however the prevailing thought is that the Albion test fishery catches may not have been proportional to the size of the South Thompson aggregate over the entire migration period. Investigators are looking at the factors which may have influenced catch rates in the test fishery (e.g. water clarity, or influence of extremely abundant co-migrating sockeye salmon in 2010). Analysis is also continuing on ageing samples collected from Chinook carcasses throughout the South Thompson aggregate with the objective of determining the representativeness of the age-specific escapements estimated using the Lower Shuswap CWT indicator stock.

Unlike 2009, the recovery of an age-5 CWT in the 2010 NBC troll fishery samples allowed for a more reliable estimate of escapement for the age class. Increasing the number of CWT recoveries remains essential to reduce uncertainty in age-specific escapement estimates. Therefore, CWT releases for the Lower Shuswap River indicator continue at a higher level than previous. Beginning in 2010, tagging was increased from 250,000 to 500,000 CWT and adipose clipped fish, and a second year of tagging occurred at the Middle Shuswap River with 150,000 CWT and adipose clipped fish. The releases in 2011 at Lower and Middle Shuswap Rivers continued at the 500,000 and 150,000 levels, respectively.

Chilko River Chinook Mark-Recapture

The 2010 escapement of summer-run (age 1.3 Stock Group) Chinook salmon to the Chilko River was estimated using a two event MR study, and concurrent aerial visual surveys. Fish behavior and distribution in the terminal area was monitored using radio telemetry. Petersen tags and sex-specific secondary marks were applied to 1,467 adult Chinook salmon captured using a combination of seining and angling. Recovery sampling was undertaken on carcasses, and 583 marked fish were recovered from a total recovery sample of 2,360 adult carcasses. The age composition of the recovery sample was 0.4% age 3_2, 51.9% age 4_2, 43.8% age 5_2, and 3.9% age 6_2. All samples showed a two-year freshwater growth pattern. Only fourteen tags were applied to jacks, of which only one was recovered from a total recovery of five jacks; therefore, a valid estimate of the jack escapement could not be calculated.

The results of the bias testing indicated that measurable sources of stress including holding time, marking, number of times recaptured, and release condition did not have a significant impact on the subsequent behaviour of the marked fish. Based on the radio telemetry and aerial survey data, the MR assumption of closure was met; however, telemetry data indicated incomplete mixing, as the majority of males and females spawned and were recovered in the same area that they were marked and released (upper and lower). As there was strong evidence of spatial bias in the application sample for both sexes and in the recovery sample for females, the Stratified Population Analysis System (SPAS) was used to estimate escapements. The results confirmed that due to incomplete mixing between the upper and lower stratum for males and females, there was a requirement to use the maximum likelihood Darroch method. The adult spawning population estimate was 7,490 (CV = 7.6%) Chinook salmon with sex-specific escapement estimates of 3,678 males (CV = 9%) and 3,812 females (CV= 12%). The Peak Count estimate of escapement based on the aerial survey data was 6,345, 15% less than the Darroch estimate. The measured peak count expansion factor was 1.82 based on the peak count of 4,124 spawners, holders, and carcasses on September 2, 2010.

Results from the radio telemetry study and analyses of the 2010 Chilko River Chinook salmon MR data will inform modifications to the study design that will minimize the potential for bias in future Chilko River Chinook salmon MR studies.

Chinook Escapement Estimation to the Skeena Using Genetic Techniques

The Skeena River has the second largest aggregate of Chinook salmon spawning populations in British Columbia and is one of the escapement indicator stocks defined by the PST for NBC/CBC. Chinook salmon escapements to the Skeena River are currently represented by an index that includes approximately 20 populations surveyed annually using a variety of techniques. The Kitsumkalum River is the exploitation rate indicator stock for the Skeena Chinook complex and spawning escapements have been estimated using a MR program since 1984. Other escapement estimates that contribute to the index are based on fish weir counts, visual observations from helicopter, fixed wing aircraft, boats and foot surveys. The index of Chinook salmon escapement to the Skeena aggregate has averaged 50,000 fish since 1984. The Kitsumkalum indicator stock represents approximately 30% of the spawners in the escapement index. The Bear and Morice River populations have contributed 20 and 26% of the escapement index, respectively, since 1984. Skeena Chinook salmon are encountered in the AABM fisheries of SEAK and NBC. They also contribute to the ISBM fisheries in NBC including gillnet, tidal sport, non-tidal sport, tidal FN and non-tidal FN fisheries. Skeena Chinook are north migrating so they do not contribute to the WCVI fisheries nor do they contribute appreciably to ISBM fisheries south of the Skeena River.

The number of Chinook salmon returning to the Skeena River in 2009 and 2010 was estimated using the proportion of Kitsumkalum River fish measured from genetic samples collected at the Tyee test fishing site and the estimate of the Kitsumkalum Chinook escapement from an independent MR project. The 2010 return of Chinook salmon to the Skeena River was estimated at 93,121 fish with a standard deviation of 18,688 fish (CV = 20%) using genetic stock identification techniques. Genetic samples were analyzed from 839 Chinook salmon caught at the Tyee Test Fishery and the proportion of the catch identified as Kitsumkalum Chinook salmon using genetic techniques was 14.7% with a standard deviation of 2.0%. The escapement of large Chinook salmon to the Kitsumkalum River was estimated at 13,712 fish with a standard deviation of 2,033 fish from an independent MR estimate.

A number of additional populations were added to the genetic baseline from the Skeena River watershed in 2009 and 2010. Existing genetic data from the 2009 Tyee Test fishery were run against the improved baseline to revise the 2009 estimate of Skeena River Chinook escapement to 80,867 fish with a standard deviation of 13,799 fish (CV = 17.1%).

The 2010 data were compared with revised genetic analyses completed for Chinook salmon samples collected at Tyee in 2000, 2001, 2003 and 2009 (Appendix Table C-5). Preliminary estimates for the Chinook return to the Skeena River had CV's between 15.2% and 17.2%. Improvements were expected in 2009 and 2010 as the sample collections were increased at Tyee and the genetic baselines were improved. However, these improvements were not realized due to broader variance around the MR estimate of Kitsumkalum River Chinook escapement.

Appendix Table C.5. Skeena Chinook salmon escapement past Tyee from the proportion of Kitsumkalum Chinook identified in the Tyee Test Fishery compared with the index.

Year	Kalum esc. from MR	SD Kalum esc.	CV Kalum esc.	N Tyee DNA	Kalum in Tyee DNA (%)	SD Kalum in Tyee DNA	CV Kalum in Tyee DNA	Total Skeena esc. from DNA	SD Skeena esc. est.	CV Skeena esc. est.	Skeena Esc. Index
2000	14,722	1,200	0.08	775	15.55%	0.020	0.13	94,668	14,401	0.15	51,804
2001	23,839	2,275	0.10	569	19.73%	0.026	0.13	120,803	19,410	0.16	81,504
2003	23,608	2,601	0.11	468	22.30%	0.029	0.13	105,857	18,162	0.17	56,758
2009	10,703	1,424	0.13	1,155	13.24%	0.014	0.11	80,867	13,799	0.17	38,597
2010	13,712	2,033	0.15	839	14.72%	0.012	0.14	93,121	18,688	0.20	43,331

SD = Standard Deviation, N = sample size, v = variance, CV = coefficient of variation, esc = escapement, est = estimate, Calculations from TCChinook (99)-3 where v(z) = z^2((v(y)/y^2)+(v(x)/x^2)) = z^2(cv^2(y)+cv^2(x))
Kalum = Kitsumkalum

An objective for the project was to provide an escapement estimate for Skeena River Chinook salmon with a CV of less than 15%. While the project failed to meet these criteria in 2009 and 2010, the preliminary estimates represent a significant improvement over existing indices since they are estimates of total passage rather than indices and these estimates include estimates of variance. Variance estimates cannot be produced for the escapement indices of Skeena Chinook because of the combination of different escapement techniques involved. Accurate determination of spawning escapements will require estimates of fishery removals upstream of Tyee and stock identification for fisheries between Tyee and the Kitsumkalum River to determine if Kitsumkalum fish suffer different fishing mortalities than other Skeena components.

Skeena Chinook Radio-Telemetry

The Skeena River is the second largest Chinook salmon producing watershed in British Columbia. It hosts more than 30 populations of Chinook which spawn in over 56 census units. In 2010, we carried out the first watershed-wide radio-telemetry project for Chinook salmon in the Skeena River. Our objectives were to tag Chinook and trace them to their spawning sites, determine the effectiveness of the latest Skeena Chinook microsatellite DNA baseline in identifying stocks, and develop information on Chinook populations in the upper Skeena. Chinook were captured, DNA samples were taken, and tags were applied near the head of the Skeena estuary with supplemental tagging at Kuldo above the Babine River. A total of 451 radio-tags were applied. Chinook locations and migrations were determined by 13 fixed stations along the Skeena and major tributaries and by 11 mobile surveys with a small airplane supplemented with boat and helicopter surveys.

Radio-tag retention was 97%. Mobile surveys located 75% and 93% of the Chinook tagged at Kwinitsa and Kuldo, respectively, and 93% of the Chinook that were tagged at Kwinitsa proceeded upstream of Oliver. Chinook movement up the Skeena River was fairly uniform, and in general, the fish moved steadily upstream at 15 to 25 km/day. As the various Chinook stocks separated and approached their destination tributaries they appeared to slow down. This was particularly evident below the Kalum River. Chinook that traveled up major tributary rivers spent significantly more time at the river confluences than fish heading further up the mainstream ($p<0.0001$ for the Bulkley, Sustut and Kispiox River confluences). The number of Chinook known to have been taken in fisheries is relatively low. Fourteen percent of the Chinook tagged in the lower river were captured in fisheries above the tagging site. Most of the terminal and in-river fishing for Chinook is by FN (66% of the total fishing).

The radio-tagged Chinook were analyzed using genetic techniques and assigned to the 32 sub-populations defined in the Skeena Chinook baseline. The genotypes of 99% of the Chinook that were submitted for analysis were successfully obtained. The overall stock abundance for the radio tagged Chinook assemblage is similar to the abundances derived from analysis of the Tyee Test Fishery collections. Recent improvements to the Skeena Chinook baseline have demonstrated the importance of the upper Skeena Slamgeesh and Squingula stocks which now appear to be among the 10 largest Skeena sub-populations. In the lower river, relatively few tags were tracked to the Kitsumkalum watershed. The tracking data and genetic analyses suggest that the Kitsumkalum run constitutes less than half of the Chinook escapement to the lower Skeena. Most of the microsatellite DNA assignments agreed with the radio-telemetry results. Slightly over half (52%) of the Chinook returned to the specific sites predicted by the baseline genetics. If we take a less stringent view and divide the Chinook cladogram into the five identified clades, then 77% of the Chinook returned to predicted spawning localities.

The widespread mobile surveys found Chinook present at all of the known spawning zones as well as being widely distributed downstream of these sites. Of the 382 Chinook that were tagged and traced to an upstream location, 30% were found outside of known or appropriate seeming spawning areas. As the mobile surveys took place near the end of the spawning season and many tags were relocated in nearby localities weeks apart, it is unlikely that these Chinook spawned. It is apparent that there are considerable losses in transit and furthermore that many Chinook end up at unexpected spawning sites. The genetic evidence and radio-telemetry data can be reconciled if the straying Chinook have low breeding success. The overall success of microsatellite DNA in predicting the clade and stock assignments of tagged fish, however modest, supports the continued use of genetic analysis of representative samples of Skeena Chinook such as from the Tyee Test Fishery to determine escapements of the larger Skeena Chinook components. The migratory delays observed with radio-tagging were much more prominent at the lower Skeena tagging site located at the freshwater end of the estuary than at the upriver site at Kuldo. Nearly 90% of the tagged fish at the lower station dropped back for some period of time and 16% never came back upriver. At the upriver tagging site, only 10% of the fish (12 of 119) dropped back downstream. The more extreme reaction to capture and tagging of Chinook in the estuary is likely related to the osmoregulatory stress of fresh water entry.

Estimate of Aggregate Population Upper Nass

The Upper Nass River Chinook salmon aggregate forms one of the existing CTC wild Chinook indicator stocks. This is a large stock group that has averaged 22,000 spawners per annum (45,000 total run) over the last decade and includes 16 separate populations including the Tseax River and all other populations that spawn within the Nass watershed, upstream of the confluence of the Nass and the Tseax Rivers. The Upper Nass River Chinook aggregate is important and represents a stable proportion of the Chinook salmon stocks taken in the AABM and ISBM fisheries in northern BC and Alaska. The Upper Nass River Chinook aggregate is a completely natural population with no history of enhancement.

Since 1994, MR estimates of the Upper Nass River Chinook aggregate have been derived by marking adult Chinook salmon (≥ 50 cm nose-fork length) with operculum tags at fish wheels operated on the mainstem Nass River near the Nisga'a community of Gitwinksihlkw. Live Chinook salmon are subsequently examined for marks at the Meziadin fishway and Chinook salmon carcasses are examined for marks at other Upper Nass River tributary locations. Carcass recovery locations have varied over the years but have been predominantly from Damdochax Creek and the Kwinageese River. Effort has been focused on these two Chinook salmon stocks as they were found to significantly contribute to the Upper Nass River Chinook aggregate population (~30%) based on stock composition results from radio-telemetry studies conducted in 1992 and 1993. From 1994 to 2008, Upper Nass River Chinook aggregate MR estimates have achieved coefficients of variation (CV) less than or equal to 15% in 9 of 15 (60%) years. The main factor determining the CV has been the number of marked adult Chinook salmon examined and recovered at terminal spawning areas in the Upper Nass River watershed. Recoveries of marked Chinook salmon at the Meziadin fishway alone have not been sufficient to generate precise MR estimates for the Upper Nass River Chinook aggregate; hence, additional recovery efforts on other tributaries are required each year to achieve a CV of 15% or less.

In 2009, the PSC funded an Upper Nass River Chinook aggregate MR program as part of the SSP where 1,213 adult Chinook were marked and 1,692 fish were examined with 57 marked recoveries to generate an Upper Nass River Chinook aggregate abundance estimate above Grease Harbour of 26,864 adults (SE=5,106; CV=13.1%). The MR study was designed to meet or exceed the data standard of generating an unbiased escapement estimate with a CV of 15% or less and to identify repeatable procedures for future studies. The additional funding received from the PSC in 2009 helped achieve the data standard for the Upper Nass River Chinook aggregate MR estimate by permitting sufficient tag recovery efforts. Two key recommendations were made from the 2009: (1) to operate a third fish wheel at Gitwinksihlkw to increase mark rates of all size groups for assessing any potential size selective biases associated with the aggregate MR estimates, and (2) to continue mark recovery operations at Meziadin Fishway, the Kwinageese weir and Damdochax Creek.

In 2010, the PSC funded Year 2 of the Upper Nass River Chinook aggregate MR program. Adult Chinook salmon were captured with three fishwheels (FW1, FW2, and FW7) operated on the lower Nass River near the community of Gitwinksihlkw from 1 June to 22 September and uniquely marked with numbered aluminum "chick-wing" tags applied to the left operculum. Of the 363 adult Chinook salmon marked at the Gitwinksihlkw fishwheels from 3 June to 6 September, 112 were censored to account for tagging related mortality and estimated in-river fishery removals between Gitwinksihlkw and Grease Harbour, leaving 251 marked fish available for recovery upstream of Grease Harbour. A total of 1,184 fish were examined for marks at upstream tributaries of which 15 were marked. Marking was influenced by extreme low water levels at Gitwinksihlkw that resulted in below average catches of adult Chinook and marks applied for recovery. Due to the small number of marked recoveries, testing for unequal probabilities of capture in either sampling event (by size, sex, age, or temporal/ spatial strata) proved difficult. However, genetic (stock and sex identification) analyses was conducted on marked fish that enabled a review of stocks that were tagged, harvested and recovered by size and sex in 2010. Using a pooled Petersen estimator, the estimated abundance of adult Chinook salmon above Grease Harbour in 2010 was 18,656 (SE = 4,494; CV = 25%). Subtracting the in-river harvests above Grease Harbour (392) yielded a net escapement (spawners) estimate of 18,264 adult Chinook salmon returning to the Upper Nass River in 2010 (95% C.I.: 11,980 to 29,222). Adding the catch (2,419) from all fisheries above the Gitwinksihlkw fishwheels to the net escapement estimate yielded an estimate of the total return of adult Chinook salmon to the Gitwinksihlkw fishwheels in 2010 of 20,683 (95% C.I.: 14,399 to 31,641).

A total of 462 Chinook salmon were successfully aged at the Gitwinksihlkw fishwheels in 2010 of which 31.2% were age 5_2, 30.3% were age 3_2, 26.0% were 4_2, and 7.8% were age 6_2. The remainder of the fish were age 2_1 (0.2%), age 3_1 (1.1%), age 4_1 (0.4%), age 4_3 (1.3%), age 5_3 (1.1%), age 6_3 (0.4%), and age 7_2 (0.2%).

The 2010 MR estimate did not meet the data standard (i.e., CV $\leq$ 15%) due to very low numbers of adult Chinook caught and marked at the Gitwinksihlkw fishwheels and subsequently recovered on the spawning grounds. Based on the results from Year 2 of this study, it is recommended that a third fishwheel (FW7) continue to be operated at Gitwinksihlkw in order to increase the sample size of marked fish. It is also recommended that adult Chinook salmon be marked at the upper Grease Harbour fishwheels if an interim target of 415 marks has not been met at the Gitwinksihlkw fishwheels by 23 June due to low water or other catchability conditions in order to reach a final target of greater than 1,000 marks on the aggregate population. Finally, mark-recovery efforts are recommended to continue at the Meziadin fishway, Kwinageese weir, and in Damdochax Creek. The provision of $97,900 from the PSC in 2010 was sufficient to support the operation of a third fishwheel at Gitwinksihlkw for additional marking and for sufficient mark-recovery efforts at Kwinageese, Damdochax and other systems. However, to ensure the CTC data standard can be achieved on an annual basis under all environmental conditions, an increase in funding in future years (~7%) would be needed to support additional tagging efforts at the Grease Harbour fishwheels when marks applied at Gitwinksihlkw are low and below target.